The FOUNDRY

Volume 51
Number 8

Published
Semimonthly

CLEVELAND, OHIO, APRIL 15, 1923

Foundry Operates Efficiently

Conservation of Time, Space, Flasks and Molding Equipment Is Effected in Method by Which Automobile Engine Cylinders of Various Kinds Are Molded, Poured and Shaken Out Continuously

BY PAT DWYER

CHARGES frequently are preferred by those outside and occasionally by those in the industry that the foundry business is the most conservative of any of the various branches of metal working. Instances are cited of the marvellous manner in which blast furnace, open hearth and rolling mill practice has developed in recent years due principally to the readiness with which the operators scrapped old ideas and old equipment and adopted new. The 600-ton blast furnace of today bears little resemblance either in physical features or method of operation to the little square stone stack of less than a hundred years ago, built on the side of a hill to facilitate charging and smelting perhaps 10 tons of iron a day. The blooming mill that breaks down a 24-inch ingot marks a long advance from the little old cogging mill where the 1-ton ingot was manipulated by brawny workmen on its way back and forth through the roll passes. The 100-ton open-hearth furnace charged with hot metal direct from the blast furnace or mixer has little to remind the old time melter of the cold charge laboriously placed on the hearth by a long peal. The machine shop has installed automatic and semi-automatic machines for the production of duplicate parts at a rate and with a precision and accuracy never contemplated by the men who were content to turn out finished parts one at a time on the old-time belt-driven engine lathe deriving its power in many cases from a high-speed, extravagant type of horizontal engine. The foundry, alone, has been pointed out as lagging behind the procession.

To a certain extent, perhaps, the charge is justified, especially in shops handling a miscellaneous line of castings in small lots. Some castings are

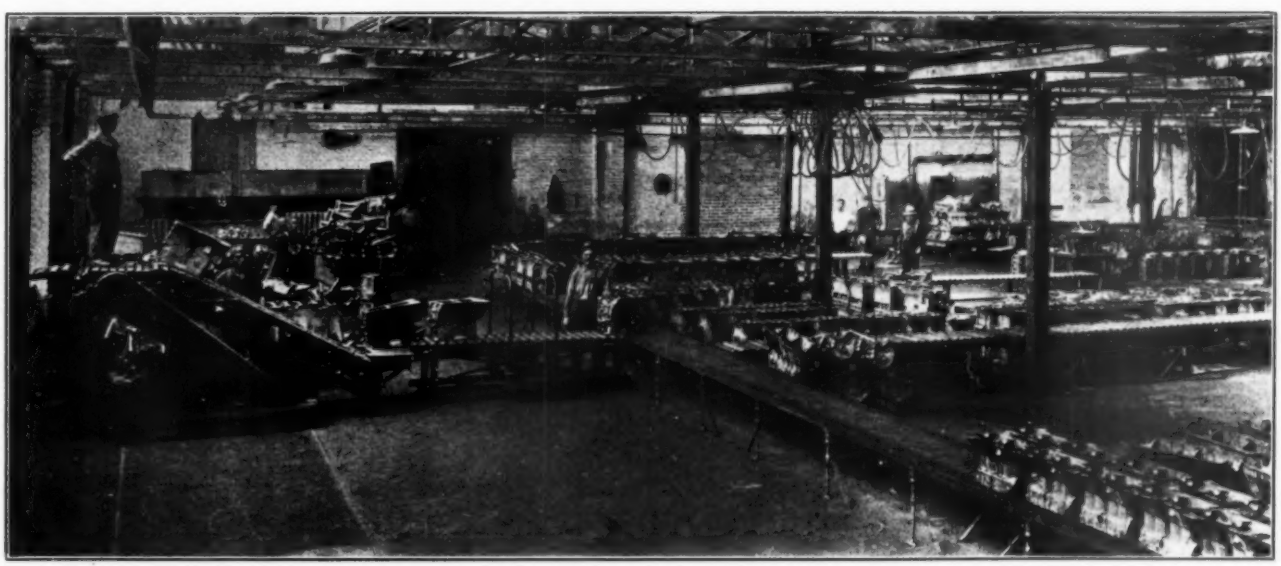
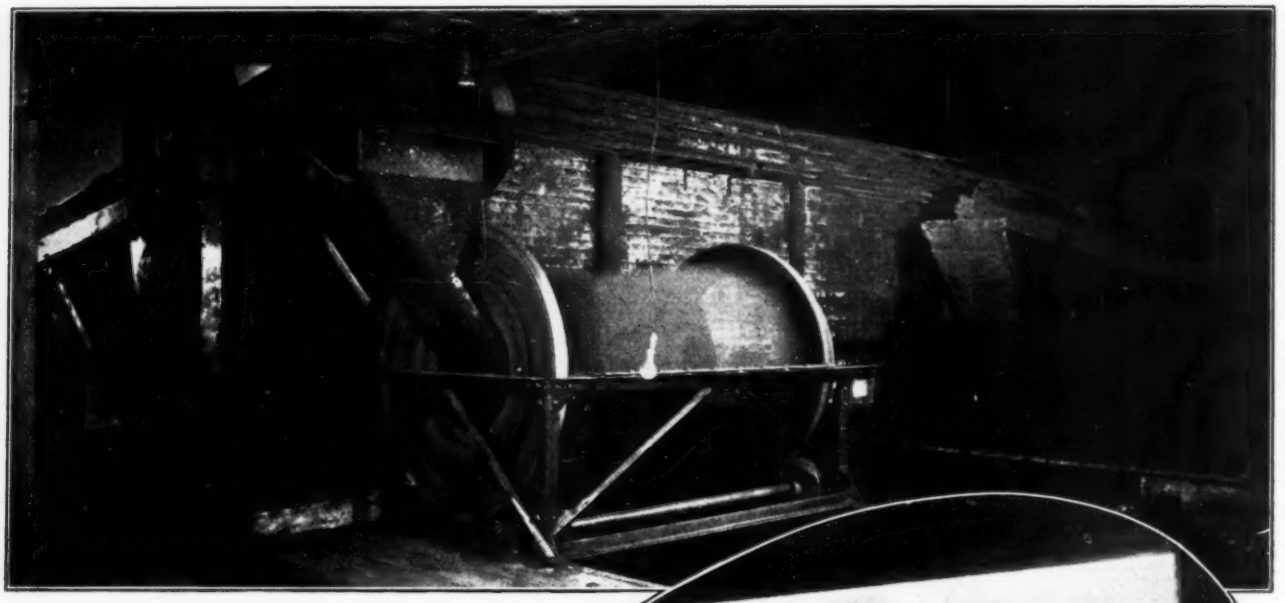
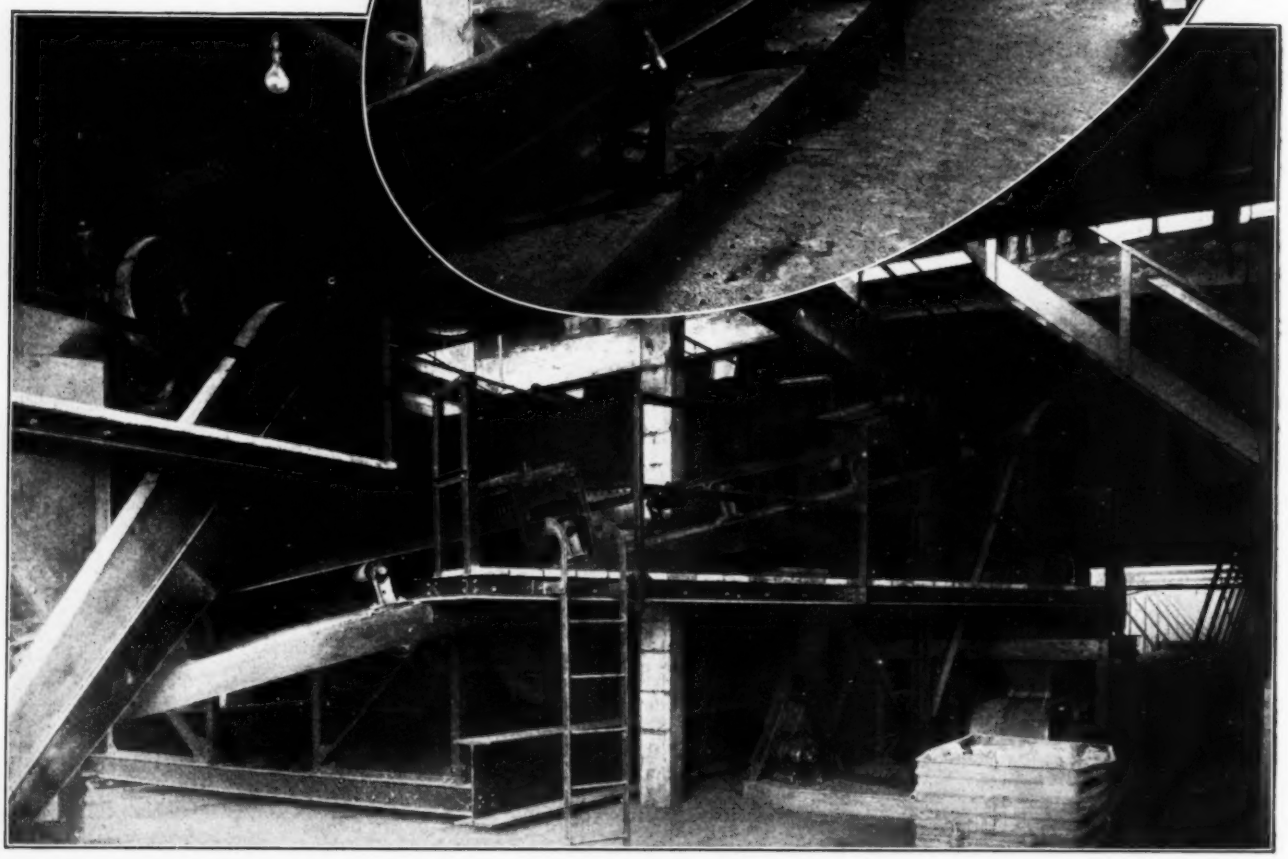


FIG. 1—THE CYLINDER WATER TESTING AND SHIPPING DEPARTMENT IS EXCEPTIONALLY WELL LIGHTED FROM OVERHEAD AND THE CASTINGS ARE HANDLED AS SHOWN





FIGS. 2, 3 AND 4—THREE STAGES IN THE PROGRESS OF THE SAND ON ITS CIRCUIT FROM THE SHAKEOUT GRATING BACK TO THE SAME POINT—ABOVE—FEEDING HOPPER AND REVOLVING SCREEN—AT THE RIGHT—BELT CONVEYOR LEADING TO VERTICAL ELEVATOR—BELOW—REVIVIFYING AND CONVEYING EQUIPMENT ON THE THIRD FLOOR

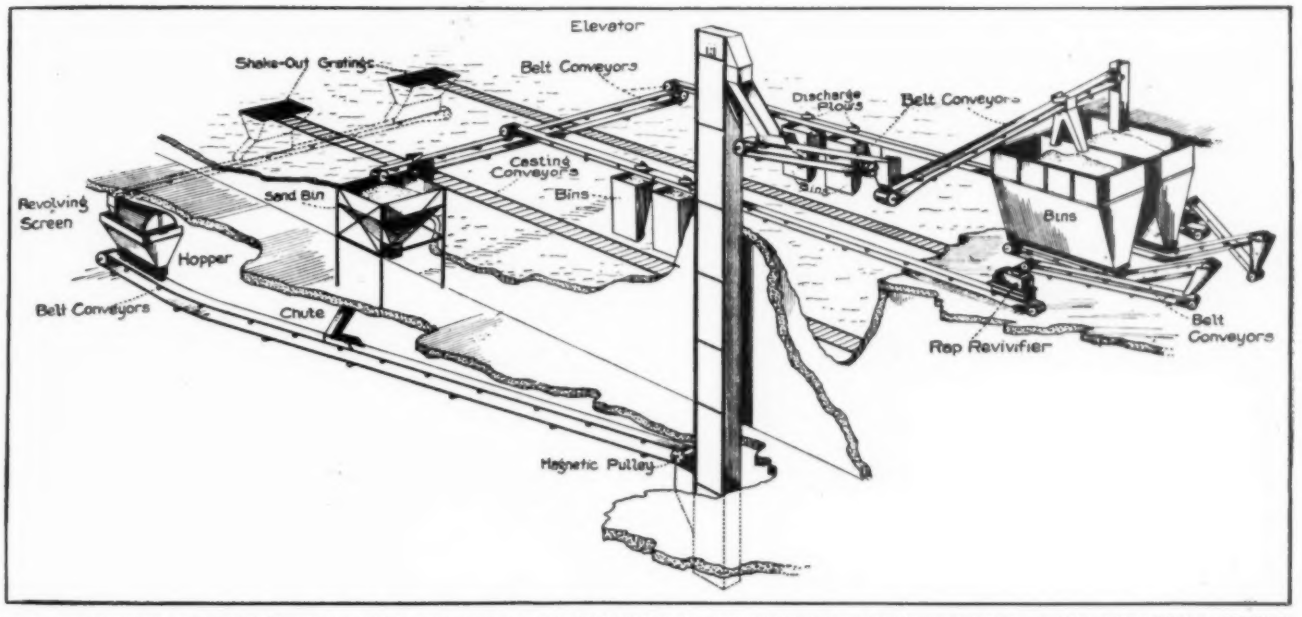


FIG. 5—GRAPHIC PERSPECTIVE VIEW OF THE SANDHANDLING EQUIPMENT WHICH SERVES TWO MOLDING UNITS

made in the floor as they were in the days of James Watt and others are made in flasks of various types and sizes. A flask may contain one pattern or it may contain a dozen. The patterns may be duplicates of each other or they all may be different, one from another. The wheelbarrow still plays a prominent part in transporting all kinds of materials including coal, coke, sand, scrap, pig iron and castings and little change has taken place in the methods of cupola operation.

However, where specialty shops, engaged in the production of vast quantities of duplicate castings, are concerned, the foundryman has no occasion to apologize and need not take a back seat in any assemblage of modern captains of industry. Mechanical equipment has taken the place of hand labor to an extent at least equal to any other branch of the metal working industry. The Ferro Machine & Foundry Co., Cleveland furnishes a noteworthy example of this fact.

Multiple molding machines, monorail hoists, mold conveyors and sand, handling equipment have been introduced, modified, expanded and changed from time to time to meet varied conditions. Interesting features in connection with installation of new equipment or methods were described at various times in THE FOUNDRY. Methods and rigging for making Ford tractor transmission housings entirely in green sand were described and illustrated in the Sept. 15 issue, 1919. Supplementary articles on the same subject appeared in Nov. 15, 1920 and April 15, 1922. The first went into considerable detail on the production of Chevrolet cylinders in green sand molds and with green sand cores. The

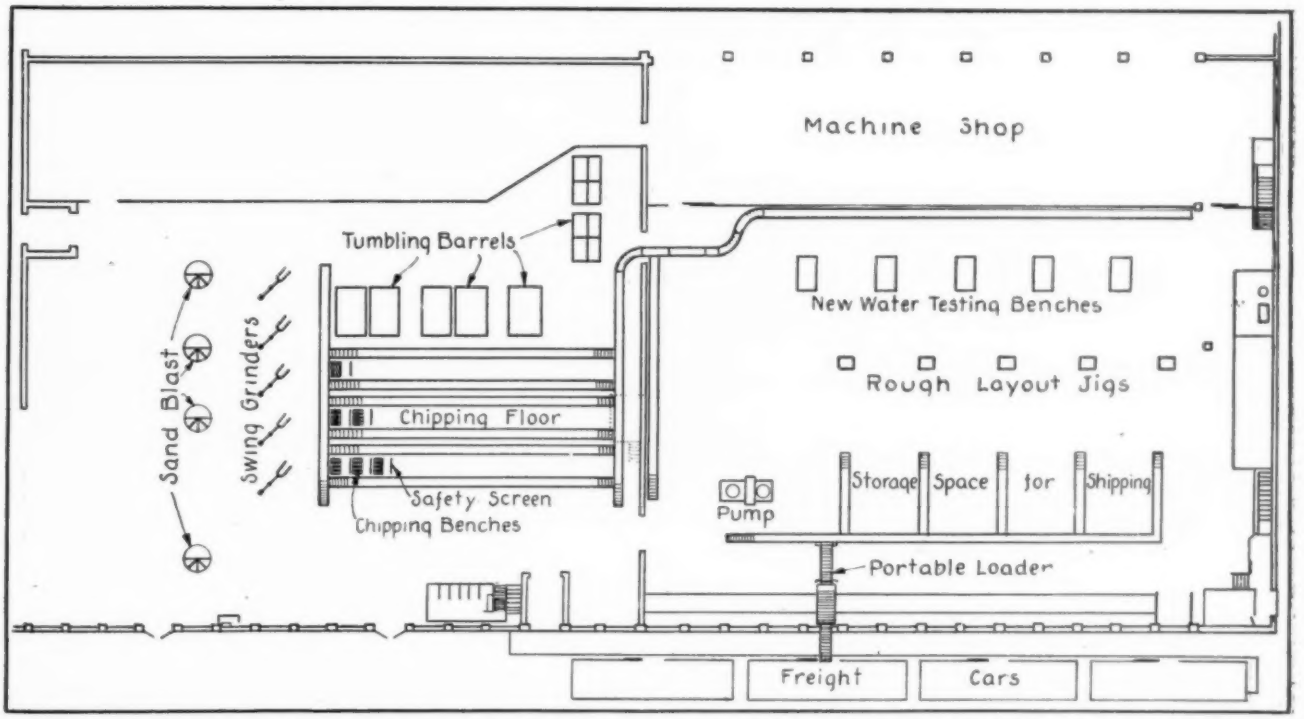


FIG. 6—GENERAL LAYOUT OF THE CLEANING AND TESTING ROOMS SHOWING LOCATION OF THE VARIOUS CONVEYORS

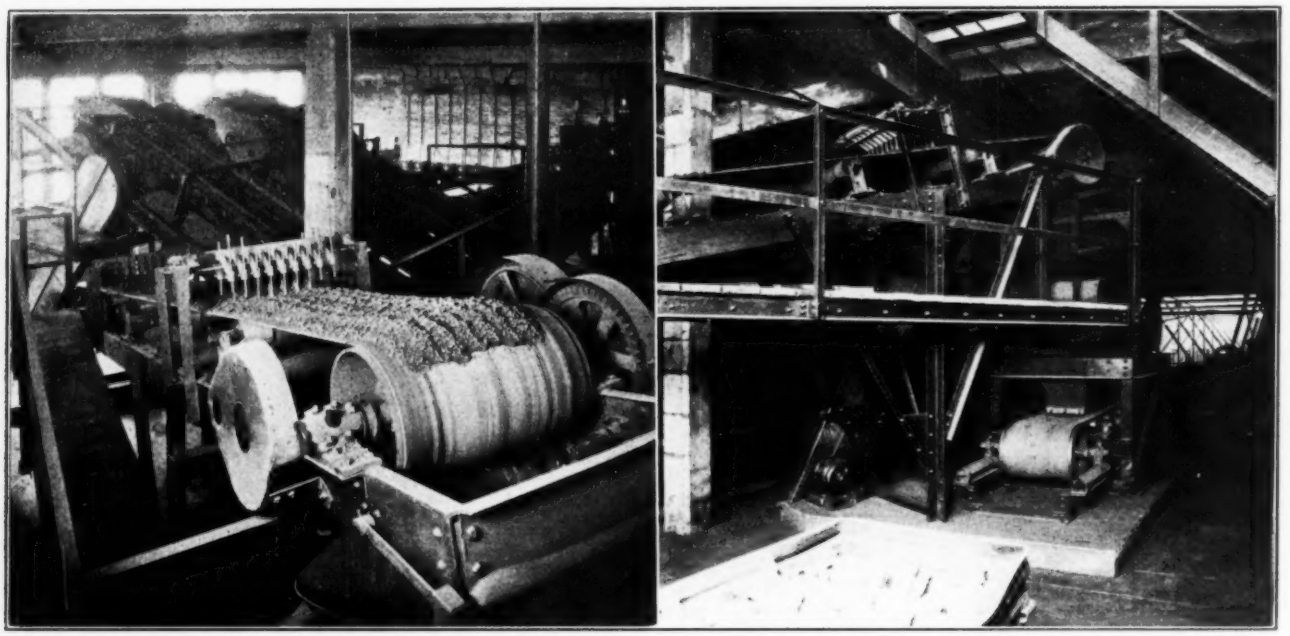


FIG. 7—DISCHARGE END OF THE BELT WHERE IT FEEDS INTO THE HOPPER LEADING TO THE REVIVIFIER—THE STEEL FLIGHT CONVEYORS ARE SHOWN IN THE BACKGROUND FIG. 8—SAND FROM THE REVIVIFIER FALLS ON A BELT WHICH CONVEYS IT TO THE HOPPERS OVER THE MOLDING MACHINES

second described a further improvement in molding machines, conveyor and sand handling equipment as applied to the production of cylinders for the Hupmobile engine. Recently, additional equipment has been installed and the general layout changed to provide for an ultimate output of 2000 automobile engine cylinders and auxiliary castings per day.

The principal features in connection with present operating conditions taking them in regular order as they apply to the production of castings are: Sand handling equipment; core room layout; molding machines; mold conveyors; monorail hoists; casting cleaning equipment and methods of handling castings in the testing and shipping department.

Three complete cylinder molding units already are in operation and a fourth to be devoted to the production of pistons is almost complete at this time. A few little kinks remain to be ironed out and a little more speed and smoothness of operation to be developed among the various gangs, but operation conditions, at present indicate that no great difficulty will be experienced in reaching the allotted quota of 1000 Chevrolet, 300 Hupmobile and 300 Paige automobile engine cylinders a day. Each molding unit is equipped with one of the molding machines made by the Stoney Foundry Engineering & Equipment Co., Cleveland, of which J. T. Stoney, vice president and foundry manager, Ferro Machine & Foundry Co., is president.

The new sand conveying equipment was installed by the Link-Belt Co., Chicago and serves two molding units located parallel to each other in one of the main divisions of the foundry. Molding and pouring goes on continuously all day and as a result the flasks are shaken out continuously over a grating in the floor near one end of the conveyor. The flask is shaken out such a short time after the cast-

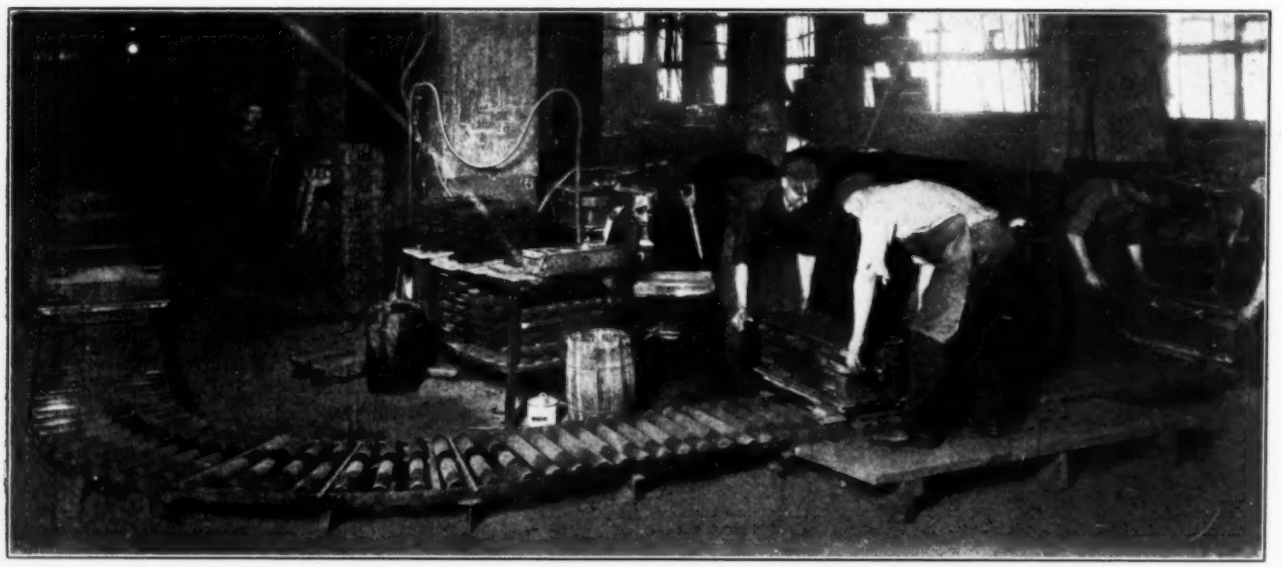


FIG. 9—CYLINDER HEADS ARE MADE AND POURED CONTINUOUSLY ON A CONVEYOR SYSTEM INSTALLED IN ONE CORNER OF THE FOUNDRY—THE MOLDS ARE POURED AS THEY PASS THE LEFT CORNER AT THE REAR AND ARE SHAKEN OUT IN THE RIGHT CORNER AT THE BACK

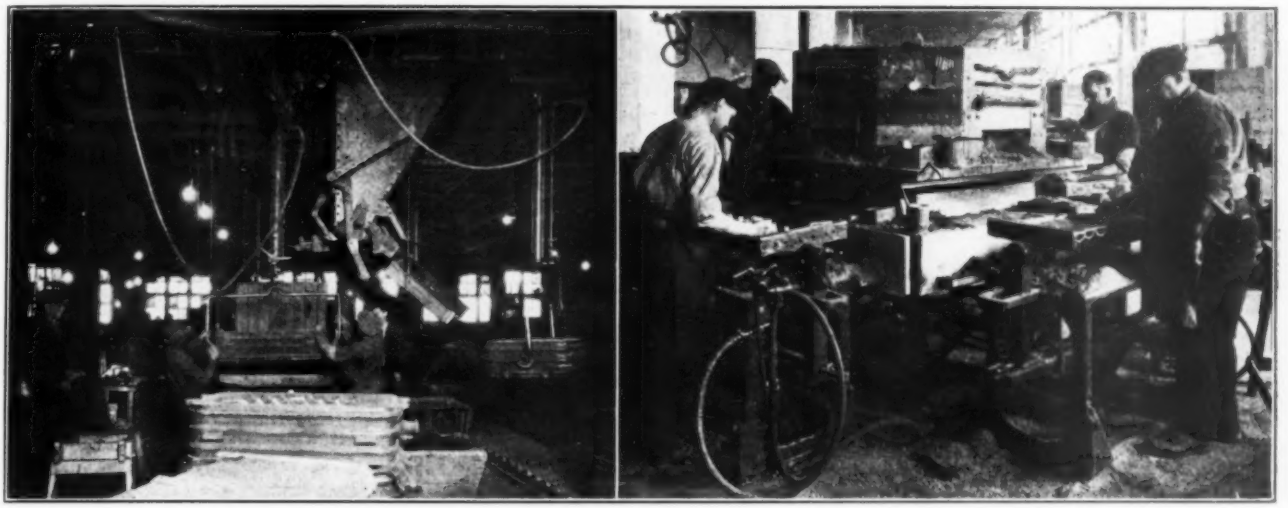


FIG. 10—SAND HOPPERS, MONORAIL SYSTEM AND MOLD CONVEYORS IN THE VICINITY OF THE MOLDING MACHINE
FIG. 11—ONE OF THE MANY RECTANGULAR COREMAKING STATIONS EQUIPPED WITH A SAND BIN AND FOUR ROLLOVER, PATTERN DRAW MACHINES

ing is poured that the sand is not dried to any extent and therefore requires little conditioning or the addition of little new sand. A pile of new sand is maintained close to the grating and approximately a shovelfull is added to the contents of each flask as it is dumped. This amount of new sand keeps the sand supply always in good working condition and also compensates for the burned sand adhering to the surface of the casting and upon which no attempt is made at reclamation.

Part of the sand handling equipment is located on each of three floors; the basement, the foundry floor proper and the floor above, the latter extends practically over the entire foundry. The greater part of the third floor is devoted to core making and will be described more in detail later.

The sand falls through a grating near one end of the mold conveyor and is conducted by a chute provided with another grating at the bottom, onto a 24-inch belt conveyor which discharges through a chute at right angles into the open end of a revolving screen approximately 10x4 feet in diameter. The screen is driven by friction rollers on the bottom near each end and therefore no central shaft interferes either with the entry or exit of the sand The end of the chute extends into the receiving end of the screen and thus insures that none of the sand will be spilled on the outside. The screen is tapered toward the discharge end and all the lumps and larger pieces of scrap eventually work out through this end by centrifugal force.

The sand falls through the openings in the screen upon a moving belt which feeds into the boot of a vertical elevator leading to the third floor. The belt runs over a magnetized pulley which removes any small pieces of scrap that escape the gratings and screen. On the third floor the bucket elevator discharges the sand onto a moving belt served by a water spray and an attendant who regulates the amount of water necessary to restore the sand to workable condition. This is purely a precautionary measure for the sand runs uniformly nearly all the time. However, occasionally a batch of dry sand comes through, hence the necessity of having a man on duty at all times.

After the sand has been sprayed with water, it is carried by the belt and discharged into a twin hopper of 80 tons capacity. This hopper feeds two molding units but since one is a duplicate of the other a description of one will serve for both.

The sand feeds steadily through the bottom of the large hopper upon a steel flight conveyor which carries it

FIG. 12—CORE OVENS ARE ARRANGED IN A LONG STRAIGHT ROW OF 21 WITH SEVEN OVENS IN A BATTERY SERVED BY A COMMON COKE FIRE

up an incline and discharges it onto a belt conveyor which in turn feeds it into a revivifier patented by A. G. J. Rapp, chief engineer, the Link-Belt Co., Chicago. This device consists of a rectangular steel casing containing a paddle wheel and a number of steel rods suspended vertically from the top. The wheel is mounted near the receiving end of the box and the rods are close to the other end. The sand from the conveyor belt falls on the paddles of the revolving wheel and is thrown directly through the labyrinth of suspended rods and eventually falls through an opening in the bottom of the casing upon a belt which passes over the hoppers which supply the molding machine. A revolving cam under one side of the casing lifts the casing and attached rods at regular intervals and the resulting jar as it falls on the frame prevents any sand from adhering either to the rods or the sides of the casing.

The belt conveyor leading over the molding machine bins extends some distance beyond and carries any sand, which has not been deflected by the plows, onto another transverse conveyor belt which discharges into a hopper. This hopper in turn is provided with a chute on the bottom which directs all this left-over sand back onto the original feed belt leading from the revolving screen to the boot of the vertical elevator in the basement.

This arrangement provides a certain amount of flexibility in operation and prevents a tie-up of the whole system any time one of the several units may be temporarily out of commission. In the remote, but always possible, contingency that a batch of sand is not properly conditioned it may be sent around the circuit twice before it is used. The various items of equipment in connection with the sand handling installation are indicated clearly in the drawing reproduced in the illustration Fig. 5.

Manufacturers of Equipment

Bottom plates
Truscon Steel Co., Youngstown, O.
Core binder
Werner G. Smith Co., Cleveland
Core racks
Truscon Steel Co., Youngstown, O.
Chipping hammers
Canton Pneumatic Tool Co., Canton, O.
Core shake out
Stoney Foundry Engineering & Equipment Co., Cleveland
Coremaking machines
Stoney Foundry Engineering & Equipment Co., Cleveland
Core ovens
F. A. Coleman Co., Cleveland
Core plates
Truscon Steel Co., Youngstown, O.
Core sand mixer
Standard Sand & Machine Co., Cleveland
Cranes
Cleveland Crane & Engineering Co., Wickliffe, O.
Cupolas
Whiting Corp., Harvey, Ill.
Flasks and fittings
Truscon Steel Co., Youngstown, O.
Molding machines
Stoney Foundry Engineering & Equipment Co., Cleveland
Core oil
Werner G. Smith Co., Cleveland
Patterns
Stoney Foundry Engineering & Equipment Co., Cleveland
Roller conveyors
Matthews Gravity Carrier Co., Ellwood City, Pa.
Sandblast sand
Portage Silica Sand Co., Youngstown, O.
Sandblast cabinets
American Foundry Equipment Co., New York
Sand handling and conveying equipment
Link-Belt Co., Chicago
C. O. Bartlett & Snow Co., Cleveland
Sand cutter
American Foundry Equipment Co., New York
Tumbling barrels
W. W. Sly Co., Cleveland
Vibrators
Stoney Foundry Engineering & Equipment Co., Cleveland

Among the advantages claimed for the continuous molding and pouring system are that it conserves floor space, reduces the number of flasks and auxiliary equipment required and that a gang of men may be drilled to carry on operations more satisfactorily than where the work is divided among small unit groups. This latter feature is regarded as being of considerable importance at the present time when foundry labor, skilled and unskilled, is difficult to secure. Where the operation of making, coring and pouring a mold is performed by a small gang of two or three men, the replacement of any one of the group presents far greater difficulties than where the same work is sub-divided among a group of 20 men. The greater the number of sub-divisions the easier it is to teach the rookie his duties.

For purpose of comparison, the following figures may be of interest. Chevrolet cylinder castings are made at the rate of 500 a day by a gang of 34 men on a floor space approximately 150x30 feet. Cylinders for the Paige and Hupomobile cars are made on approximately the same floor area on parallel sides of one of the main bays of the foundry. One of these cylinders is considerably larger than the other but the objective of 300 castings a day for each one from a gang of nineteen men practically has been achieved. Two men make the drags, two men make the copes, two men finish the molds and spray the surface with a mixture of gasoline and plumbago, five men set the cores, one man clamps the flasks, two men push the molds along on the conveyor, two men pour the iron and three men shake out the castings and place the

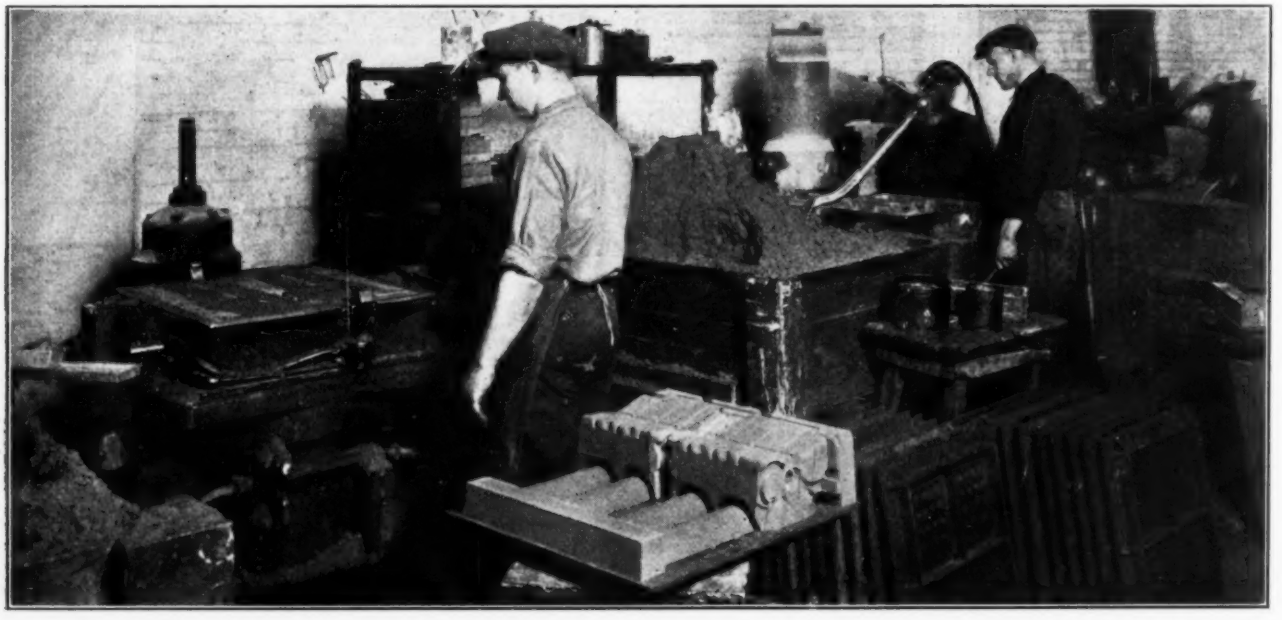
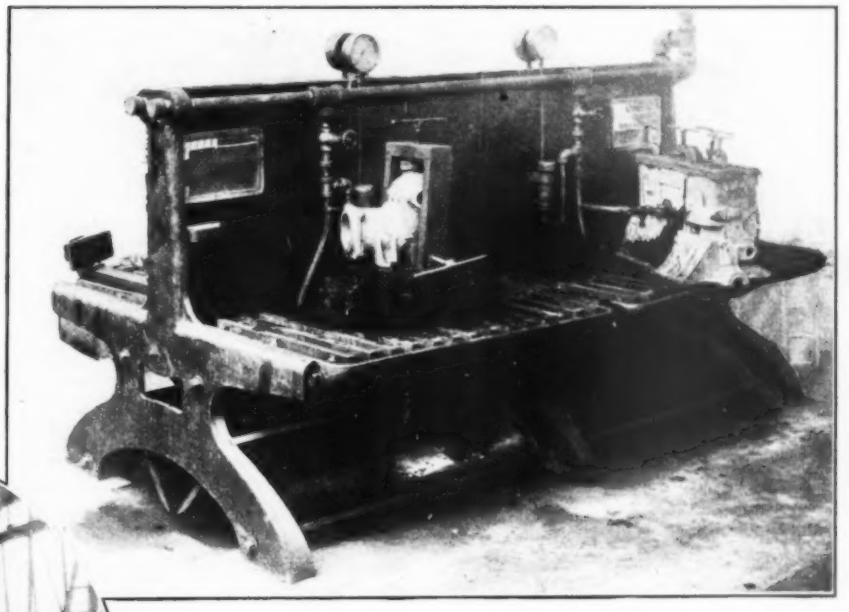


FIG. 13—CYLINDER BODY CORES ARE MADE IN A BATTERY OF ROLLOVER PATTERN DRAW MACHINES

empty flasks back onto the conveyor.

On a weight basis the output figures out as 1617 pounds per man on the Chevrolet, 3705 pounds per man on the Hupmobile and 4235 pounds per man per day on the Paige cylinder castings. Another interesting feature disclosed in making Hupmobile and Paige cylinder castings on similar molding equipment is that although the Paige flask is approximately 25 per cent larger than the flask employed for the Hupmobile, a like number of men in each gang produces the same number of molds per day of 8 hours.

The molds are poured and shaken out almost immediately after they are closed and in that manner a supply of 30 flasks has been found ample to keep the molding machine going to capacity. A total of 300 molds a day means a little better than one every two miutes and from this it is apparent that not more than 12 or 14 are on the conveyor at one time. The remaining flasks are stacked in the vicinity of the molding machine or are on their way back in that direction.



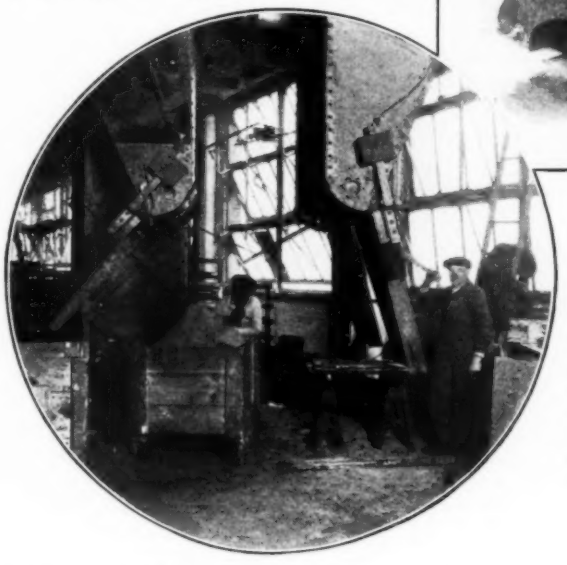


FIG. 14—CORE SAND IS MIXED OVERHEAD AND DROPPED THROUGH A HOPPER INTO BOXES THAT AFTERWARD ARE TAKEN TO THE VARIOUS COREMAKING STATIONS FIG. 15—ONE OF THE TIDY, CONVENIENT CAST IRON BENCHES ON WHICH THE CASTINGS ARE WATER TESTED

In a trial run on March 23 forty-two cylinder castings were made in one hour.

The amount of sand handled in a day may be calculated from the size of the flasks and the number employed during the day. The flask for the Chevrolet cylinder measures 21x30 inches with a combined depth for cope and drag of 18 inches. This is approximately 7 cubic feet, but since the mold occupies about half the space the amount of sand will be only 3½ feet. Sand weighs 80 pounds to the cubic foot and therefore on a basis of 500 cylinders a day, the amount of sand involved will be 3½x80x500, or 70 tons Applying the same method to figuring the amount required for the Hupmobile cylinder made in a flask 26½x34½x24 inches and the Paige cylinder made in a flask 27½x43x25½ inches it is found that the former requires 75 tons of sand and the latter 90 tons of sand during the same period. The sand makes the round trip about once an hour and since it does not become extremely hot owing to the short time it remains in contact with the hot casting, it is quite cool and in condition by the time it is returned to the molding machines. The large reserve amount of cold sand in the storage hoppers on the third floor and also the amount in the hoppers over the machines insures satisfactory sand at all times.

Making the Mold

Each molding unit contains one twin molding machine, two sand hoppers, one roller conveyor at the front and one at the back of the machine and one monorail system overhead provided with suitable switches and hoists to facilitate handling the flasks when either full or empty. The molding machine is of the latest type made by the Stoney Foundry Engineering & Equipment Co., Cleveland. It is similar in many respects to the machine described in the April 15, 1922 issue of THE FOUNDRY, but has been changed in some particulars so that it is claimed that it is faster and more efficient than formerly. For example, the anchor hooks designed to hold the squeezer head in position are more conveniently located and the stripping device is operated from a piston inside the cylinder instead of as formerly where the outside cylinder casing was pushed up carrying the stripping plate arms with it. The adjustment of the jolting cylinder also has been changed to some extent so that the stroke is faster and more powerful than formerly.

The molding machine is equipped with two patterns, one for the cope and the other for the drag and both parts of the mold are jolted and squeezed at the same time. The two flasks are filled with sand from overhead hoppers each provided with a swinging spout and automatic gate that opens when the spout is swung over the flask and closes when the spout is released. The spout is counterweighted so that except when held over the flask, it is out of the way of the men working around the machine. This feature is illustrated in Fig. 10.

One side of the conveyor on the Paige floor shown in Fig. 10, is formed of steel plates and is power operated. The other side and also the entire conveyor on the other floors are plain roller conveyors on which the loads are moved by hand. This system extends into the cleaning and chipping rooms where roller conveyors made by the Matthews Gravity Roller Co., Ellwood City, Pa., serve to convey the castings from point to point on the outward journey toward the shipping platform. The monorail equipment was supplied by the Cleveland Crane & Engineering Co., Wickliffe, O.

The conveyor serving each molding

machine is approximately 140 feet in length made up of two branches joined at one end and open at the other. The molds are lifted from the molding machine and laid down one after the other on one branch of the conveyor, where they are cored and closed. They are moved constantly toward the open end of the conveyor and are poured at a point approximately half way between the closing station and the shake out grating.

Two air hoists suspended from a monorail on each side of the molding machine are employed in handling the flasks. Those on one side handle the empty flasks from the conveyor to the machine and the other two handle the flasks after they are rammed. This feature is illustrated in Fig. 10.

An oval monorail track, 30 feet in length, located above the shakeout end of the conveyor, supports an air hoist provided with a special shakeout bail made by the Stoney Engineering & Foundry Equipment Co., Cleveland. The bail is equipped with a powerful air operated vibrator which eliminates any necessity of employing sledge hammers to knock the sand out of the flasks. The flask is picked up in the usual manner from the loaded side of the conveyor, pushed around the curve until it hangs suspended over the grating in the floor. The vibrator then is set in motion and after the sand has been shaken out the flask is pushed further around the curve and lowered on to the branch of the conveyor designed to carry the flasks back to the vicinity of the molding machine. After the flask is dropped, the hoist is pushed around the other end curve on the monorail and the bail is attached to the next following flask.

Owing to the manner in which the Ferro Company has expanded and developed, the core department has been located at various times in different parts of the group of buildings comprising the foundry. The latest addition extends along one side of the foundry building and is located on the floor above the molding floor. Views of four parts of the core room are shown in Figs. 11, 12, 13 and 14.

The core sand is unloaded through suitable openings in the railroad track outside the building and taken to bins in the basement by a conveyor belt. A vertical bucket elevator and other equipment takes the sand to the floor above the core room where it is mixed in a revolving paddle type mixer made by the Standard Sand & Machine Co., Cleveland and then discharged through the hoppers shown in Fig. 14 into boxes that are taken to the various core making stations by an electrically operated lift truck.

Arrangement Temporary

The latter part of this arrangement is only temporary until the three monorails suspended from the ceiling and extending from end to end of the room are completed. Molding stations similar to that shown in Fig. 11 are located on the floor in three staggered rows almost the entire length of the room. Each row is in a position where it may be served by a carrier traveling on the monorail immediately above it. Each stand is equipped with a sand bin and four roll-over, pattern draw core machines and forms in effect a quadruple coremakers bench for making the water jacket cores.

A typical unit for making cylinder body cores is shown in Fig. 13. On account of the many loose pieces in the corebox, the sand is rammed by hand, but the machine on which the corebox is mounted is the rollover type and draws the box off the core. The core is lifted from the machine to a stand similar to that shown behind the operator in the foreground Fig. 13 and later is placed on a rack and carried to the oven. The new core room is light, airy and is considered quite an improvement over the rooms formerly devoted to the making and baking of cores. Three 7-oven batteries of core ovens arranged in a straight row as shown in Fig. 12 were erected by the F. A. Coleman Co., Cleveland. One coke-burning firebox at the end serves each battery. Each battery is equipped with an individual stack and a fan blower which exhausts the steam out of the ovens during the initial baking period. Each oven has a capacity of two racks and is provided with dampers, top and bottom through which the heat may be controlled. An interesting feature in connection with these ovens and one that renders them rather unique among oven installations is that they are suspended from a number of steel rods. The floor was not designed originally to support the weight of the ovens and therefore it became necessary to take care of the weight in some other manner. Finally a method was adopted by which a number of steel rods were attached to the roof trusses on the top and steel plates on the floor below. The frames of the ovens were attached to these rods in a position that brings the floor of the oven on a level with the floor of the core room on

FIG. 16—HEAVY WIRE SCREENS PROVIDE A SAFETY FACTOR BETWEEN THE VARIOUS INDIVIDUAL CHIPPING STANDS

Foundry Tourists Who Will Visit Europe

D. G. Anderson; Pittsburgh Engineering Co., Jeanette, Pa.
E. K. Bacon; Mansfield, O.
A. Baillot, wife and daughter; Hull Iron & Steel Foundries, Ltd., Hull, Quebec
N. T. Booth and wife; Bethlehem Steel Co., Bethlehem, Pa.
F. J. Buckley and wife; 737 Academy street, Kalamazoo, Mich.
G. H. Clamer, wife and daughter; Ajax Metal Co., Philadelphia
W. A. Coventry and wife; Grey Iron Casting Co., Mt. Joy, Pa.
Charles F. Drozeski, 399 Keystone avenue, River Forest, Ill.
E. J. Flaherty, wife and daughter; Johnson Bronze Co., New Castle, Pa.
Benjamin D. Fuller; 614 Main street, Niagara Falls, N. Y.
C. S. Gilbert and wife; Canada Iron Foundries, St. Thomas, Ont.
W. R. Gilmore; Superior Steel Castings Co., Benton Harbor, Mich.
D. O. Green and wife; American Hominy Co., 130 North Wells street, Chicago
George Hanson; Havana, Ill.
John Hill and wife; Hill & Griffith Co., Cincinnati
Vitus J. Honha and wife; 1911 South Avers avenue, Chicago
C. A. Jackson; Louisville, O.
A. F. Jensen and wife; Hanna Engineering Works, Chicago
Percival Johnson and wife; 1008 Real Estate Trust Building, Philadelphia
Jesse L. Jones; Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
G. M. Knotts and wife; United Engineering & Foundry Co., Youngstown, O.
George H. Laib and wife; Columbia Sanitary Manufacturing Co., Louisville, Ky.
M. B. Lambert; 5328 Harper avenue, Chicago
J. S. McCormick; Twenty-fifth street & A. V. railroad, Pittsburgh.
Verne E. Minich and wife; 366 Madison avenue, New York
T. H. Monaghan and wife; 1355 West Washington boulevard, Chicago
Harry D. Mousley and wife; 2409 Cedar street, Philadelphia
A. J. Mummert and wife; McQuay-Norris Mfg. Co., St. Louis
J. B. Nordholt and wife; Toledo Steel Castings Co., Toledo, O.
Edward S. Norrel; E. C. Atkins & Co., 402 South Illinois street, Indianapolis
Clifton D. Pettis; 14 East Sixtieth street, New York
H. P. Putnam, wife and daughter; 3726 Cortlandt street, New York
W. S. Quigley and wife; 26 Cortlandt street, New York
Carl B. Ruefly; Dover Manufacturing Co., Dover, O.
Bartlett M. Shaw and wife; Walker & Pratt Mfg. Co., Watertown, Mass.
R. F. Sherwin and wife; Chicago Hardware Foundry Co., North Chicago
T. S. Snyder; Pittsburgh Rolls Corp., 41 Willow street, Pittsburgh
A. J. Theisen; Great Lakes Foundry Co., Port Huron, Mich.
Jacob Walthers and wife; Dayton Steel Foundry Co., Dayton, O.
Walter Wood; 400 Chestnut street, Philadelphia

the second story. A large freight elevator at each end of the core room furnishes a ready means of taking the cores to the various molding machines.

After the castings are shaken out, they are loaded on trucks and taken outside the building where they are allowed to cool. As a preliminary to the cleaning process they then are taken to a small building recently erected equipped with a special device which removes the cores and all sand adhering to the surface. This device is equipped with a powerful vibrator designed and built by the company.

The castings then are trucked back to the tumbling barrels and sand blast machines. The smaller castings are cleaned in four sand blast machines made by the American Foundry Equipment Co., New York, and also in a battery of nine tumbling barrels made by the W. W. Sly Mfg. Co., Cleveland. The larger castings are cleaned in a battery of nine large rectangular tumbling barrels supplied by the same interest

The cylinder castings pass in front of a battery of four swing grinders before they are placed on roller conveyors and with the exception of the time they are detained at various points for chipping, testing and gaging they remain on the conveyor until they are packed in a freight car or automobile truck for shipment.

General layout of the cleaning and shipping room is shown in Fig. 6. Six parallel conveyors carry the castings between rows of individual chipping benches to a single cross conveyor leading into the room where the castings are water tested and gaged. Heavy wire screens are suspended between each pair of chipping benches to prevent injury to the workmen from flying chips. This feature is clearly shown in Fig. 16. The castings are tested on a set of five benches similar to that shown in Fig. 15. This type of bench was designed by E. W. Beach, president and general manager of the Ferro Machine & Foundry Co. It is made up of a number of cast iron sections fitted together without any machine work. Each bench is fitted with a pair of sloping drain boards which conduct the spent water into an opening in the floor leading to a drain and as a result the floor in the vicinity of the testing bench always is clean, dry and tidy.

From the water testing benches the castings are taken to any one of four surface plates where they are gaged by a set of metal templets to verify general dimensions, machining allowance and the relative position of the various surface projections. A portable section of the conveyor takes the castings from one of the transverse conveyors to a power driven conveyor shown to the left in Fig. 1 which delivers them into the railroad cars on the outside of the buildings.

American Foundry Party to Visit Europe

In response to the invitation received from the Association de Fonderie de France to visit the International Foundrymen's convention and exhibition in Paris and subsequent invitations from the Foundrymen's Association of Belgium and from the Institute of British Foundrymen. Many American foundrymen with members of their families have signified their intention of making the trip.

A complete list to date of those contemplating the trip is shown in the accompanying box:

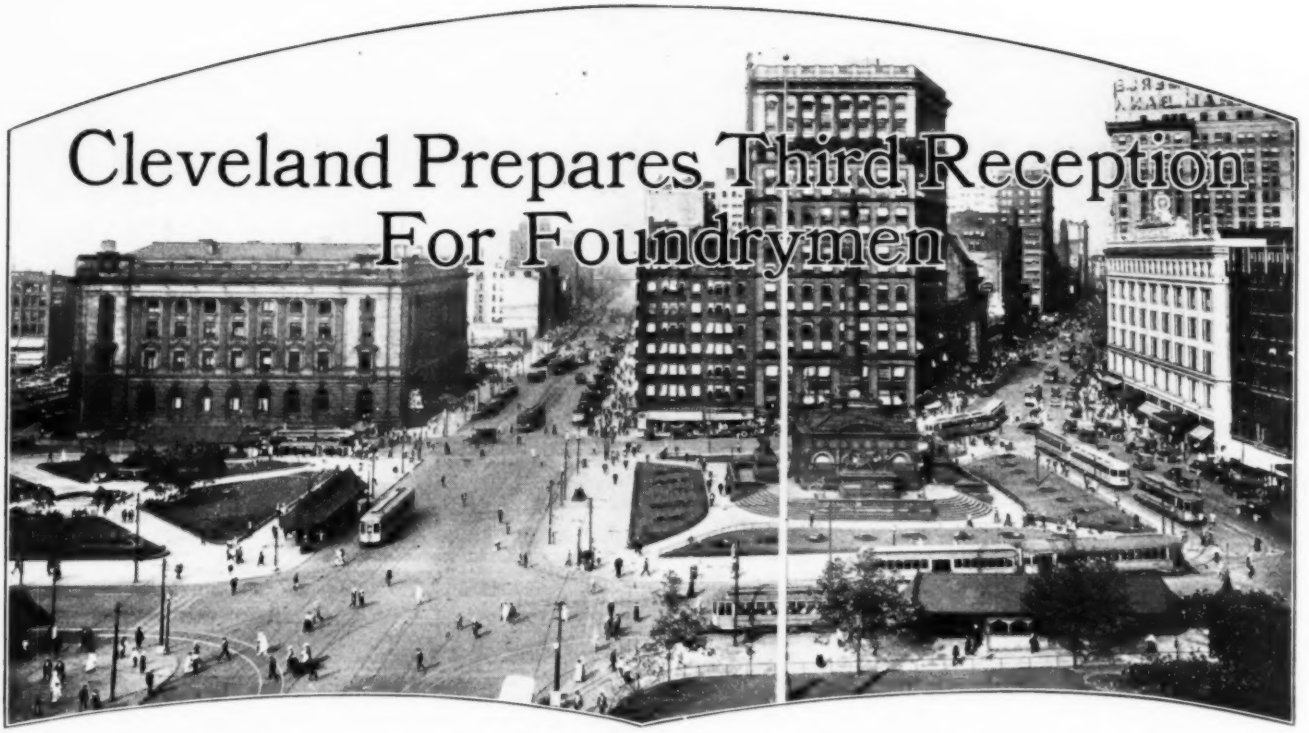
H. Cole Estep, London, England, is chairman of the committee on international relations, Stanley E. Flagg Jr., is vice president and C. E. Hoyt, secretary of the association, Marquette building, Chicago, is also secretary of the committee. Other members of the committee are L. L. Anthes, Anthes Foundry, Ltd., Toronto, Canada; A. O. Backert, Penton Publishing Co., Cleveland; G. H. Clamer, Ajax Metal Co., Philadelphia; and Franklin Go. Smith, Osborn Mfg. Co., Cleveland.

Disposes of Dust from Sand Blast

Profitable use for the dry dust accumulating in its sand-blast dust arresters has been found by a Pennsylvania steel foundry. The local highway department, after trying out the dust for covering newly laid asphalt until it sets, has found the dust gives satisfactory service. Consequently the steel company has been able to make arrangements with the highway department to take all the dust accumulating in its sand-blast apparatus. The dust is bagged in paper cement bags furnished by the highway department which also pays the handling charges.

Cooley-Wright Mfg. Co., Waterbury, Vt., has been appointed distributor for Maine, New Hampshire, Vermont and Northern New York by the Globe Iron-Crush & Shot Co., Mansfield, O.

Cleveland Prepares Third Reception For Foundrymen



WITH experience gained on two former occasions and with better facilities than ever before to handle the convention and exhibition, Cleveland, the fifth city in population in the United States, is prepared to take care of the gathering of foundrymen on April 28 to May 3 in a manner worthy of the occasion, the character of the assemblage, and in full justice to its reputation as one of the greatest casting centers in the country.

The first joint meeting of the American Foundrymen's association and the associations engaged in the manufacture of foundry equipment and supplies in 1906 was held in Cleveland and a second meeting of a similar character was held in 1916. Annual meetings have been held regularly since the organization of the American Foundrymen's association in 1896 with the single exception of 1921 when, on account of the universal business depression, the executive board decided to postpone the meeting for nine months. Due to this change, the meeting scheduled to take place in the fall of 1921 did not take place until June last year in Rochester, N. Y.

Historically, geographically, and upon its merits as a great iron and steel town, Cleveland commends itself in a peculiar and appropriate manner as a meeting place for men engaged in the casting industry. The number and extent of the foundries, the methods and processes in vogue for rapid and huge production and the universal courtesy displayed by plant executives in their treatment of visitors are proverbial and no doubt will prove an inspiration to the thousands of foundrymen who will spend a few days in Ohio's first city.

Traveling by water was easier than it was by land in the days when Gen. Moses Cleaveland and party of surveyors crossed the wilderness that separated the Atlantic states from the vast unexplored territory known as the Western Reserve, on the south side of Lake Erie. The arduous trip was made the greater part of the way by boat and involved some long and difficult portages including that around the rapids and awe inspiring falls of the Niagara. Coasting along the southern shore of Lake Erie for a suitable landing place and a site for a settlement, the General discovered the mouth of the Cuyahoga river and in July 22, 1796, formally established a settlement.

Euclid avenue the present fashionable thoroughfare and great retail shopping district, originally was a buffalo trail leading east and west, high and dry above the level of the adjacent lake. It also served as a war trail for the roving tribes of Indians and, closely following the indentations in the shore, extended from the site of the present city of Detroit on the west to where Buffalo, once known as the Queen City of the Lakes, now guards the outlet of the waters from Lake Erie.

Starting in 1800 with a population of 25, the village had grown to 300 by 1810 and after that the population increased quite rapidly. For example, it jumped from 1075 in 1830 to 6071 in 1840 and then approximately doubled every 10-year period up to 1890 when the census showed a return of 261,353. In 1900 the population was given as 381,768, in 1910 it was 560,663 and in 1920 when the last official census was taken the population of the city was given as 796,836. At the present time the population of Cleveland, including that in a few, as yet unannexed, suburbs is approximately 1,000,000. At the time the city was founded a value of $1,200,000 was placed on the 3,000,000 acres of land comprising the eastern part of the Western Reserve. In 1920 the land value in Cleveland alone was $644,000,000 and the estimated value of the property was $1,753,246,190.

Cleveland owes its rapid growth and dominating position to its favorable geographical location at a point where several great trade routes cross each other.

Condensed Program

Saturday, April 28

10:00 a. m.—Opening of registration and exhibits, Public hall

Monday, April 30

2:00 p. m.—Nonferrous—aluminum and aluminum alloys
Joint meeting with Institute of Metals division, American Institute of Mining and Metallurgical Engineers
2:00 p. m.—Steel foundry session

Tuesday, May 1

9:30 a. m.—Industrial education—training foundry workers
9:30 a. m.—Nonferrous—brass and bronze foundry practice
Joint meeting with Institute of Metals division, American Institute of Mining and Metallurgical Engineers
2:00 p. m.—Sand research—test methods
4:00 p. m.—Business meeting—report of officers

Wednesday, May 2

9:30 a. m.—Sand research—reclamation and conservation surveys
2:00 p. m.—Malleable session
2:00 p. m.—New developments in the foundry industry
6:30 p.m.—Annual banquet, Hotel Cleveland

Thursday, May 3

9:30 a. m.—Steel foundry session
9:30 a. m.—Gray iron session
2:00 p. m.—New developments in the foundry industry

The water borne commerce of the Great Lakes converges to this city, the nearest point on the south shore of Lake Erie to the vast coal deposits of Pennsylvania. Railroad builders noted with approval the easy and direct grades leading east, west and south from Cleveland and the railroads, possibly more than fourth side offering low freight rates and ready means of transportation east, west and north, and the fact that it is a central point between the vast ore deposits of the Northwest and the fuel from the southern Ohio and Pennsylvania coal fields.

The city is fifth among American cities in the value of manufactured products as well as in population. In diversity of products probably it is first. The United States census bureau lists all manufactured goods under 264 heads and out of this total Cleveland is credited with 218. The number of productive workers is set down as 105,000, the number of manufacturing plants as 2400, and the annual production of finished material is valued at $350,000,000.

During the recent war the claim was made for the city that it could make in part or entire in many instances, every single piece of war equipment from the tiniest screw of a range finder to the cargo boats of the emergency fleet corporation. The boats were designed, laid down, erected, equipped, launched and loaded in Cleveland yards and then dispatched under their own steam through the inland waterway leading to the Atlantic ocean.

In connection with the shipping industry, it is interesting to note that vessels have been built in the district

any other single factor, are responsible for the prestige enjoyed by the city as a great manufacturing and distributing center.

Other natural advantages that combine to the same end are the extensive area of level land surrounding the city on three sides, providing room for easy industrial expansion; the lake on the

Tentative Program of Technical Sessions

Monday, April 30

Nonferrous—Aluminum and Aluminum Alloys
Joint Session with Institute of Metals division, A.I.M.E.

2:00 p. m.—Linear Contraction and Shrinkage of Some Aluminum Alloys, by R. J. Anderson, United States bureau of mines, Pittsburgh
Density of Magnesium from 20 Degrees Cent. to 780 Degrees Cent., by J. D. Edwards and C. S. Taylor, Aluminum Co. of America, New Kensington, Pa.
Aluminum and Light Alloys, by M. de Fleury, France. Annual exchange paper of the Association Technique de Fonderie
Casting Aluminum Radiator Shells, by W. A. Mills, Alloy Foundry & Machine Corp., New Rochelle, N. Y.

Steel Foundry Session

3:00 p. m.—Electric Furnace Practice in the Foundry, by M. W. Carruthers, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Production of Light Steel Castings for Ordnance Work, by Major Minton, United States ordnance department, Watertown arsenal, Watertown, Mass.
Heat Generation in Open-Hearth Practice, by A. D. Williams, Cleveland
Centrifugal Casting of Steel, by W. McConway, McConway & Torley Co., Pittsburgh
Report of committee on Specifications for Steel Castings

Tuesday, May 1

Industrial Education—Symposium on Training Foundry Workers

9:30 a. m.—W. F. Simon, apprentice division, Industrial Commission of Wisconsin, Madison, Wis.
L. A. Hartley, Nebraska department of vocational education, Lincoln, Nebr.
C. M. Morrin, Brown & Sharpe Mfg. Co., Providence, R. I.
A. B. Mays, University of Illinois, Urbana, Ill.
J. Grennan, University of Michigan, Ann Arbor, Mich.
A. L. Williston, Wentworth institute, Boston
L. W. Klein, Coxe Traveling Grate Co., Port Carbon, Pa.
H. A. Frommelt, Falk Corp., Milwaukee, Wis.
O. W. Potter, University of Minnesota, Minneapolis, Minn.
F. W. Kirby, Deere & Co., East Moline, Ill.
E. A. Parker, Springfield Aluminum Plate & Casting Co., Springfield, O.

Nonferrous Foundry Practice
Joint Session with Institute of Metals Division, A.I.M.E.

9:30 a. m.—Notes on the Proper Pouring and Melting of Brass and Bronze, by F. L. Wolf and W. Romanoff, Ohio Brass Co., Mansfield, O.
Casting Bronze Tablets, by Jacob G. Kasjens, Brass Foundry Co., Peoria, Ill.
Present Status of Crucible Making, by B. L. Berkey
Contraction and Shrinkage of Nonferrous Alloys, by R. J. Anderson, United States bureau of mines, Pittsburgh, and E. G. Fahlman, National Smelting Co., Cleveland
Effect of Heat Treatment on Release of Stress in Bronze Castings, by R. J. Anderson, United States bureau of mines, Pittsburgh, and C. L. Eldridge, Metropolitan Museum of Arts, New York

Sand Research—Testing Methods

2:00 p. m.—Reports of committee of the American Foundrymen's association and the National Research council on molding sand investigation
The Cohesiveness Test of Foundry Sands, by H. Ries and C. M. Nevin, Cornell university, Ithaca, N. Y.
A Physical Test for Foundry Sands, by E. W. Smith, Crane Co., Chicago

Wednesday, May 2

Sand Research, Reclamation, Conservation and Geological Survey Work

9:30 a. m.—Reports of subcommittees of joint committee of the American Foundrymen's association and the National Research council on Molding Sand Investigation

Malleable Session

2:00 p. m.—Address by Enrique Touceda, Albany, N. Y.
Application of Fuel Oil to the Malleable Air Furnace, by A. V. Landschoot, Iowa Malleable Iron Co., Fairfield, Iowa
Hardened and Tempered Malleable Castings, by E. D. Smith, Lakeside Malleable Co., Racine, Wis.
Tunnel Kiln for Annealing Malleable Castings, by Philip Dressler, American Dressler Tunnel Kiln, Inc., Cleveland
Malleable Iron Cast in Small Quantities, by S. J. Felton, Ohio Mechanics institute, Cincinnati
Methods of Checking Scrap, by E. D. Halsey, Terre Haute Malleable & Mfg. Co., Terre Haute, Ind.

New Developments in the Foundry Industry

2:00 p. m.—Centrifugal Casting of Iron Piston Rings, by John A. Rathbone, Detroit
Centrifugal Casting, by Leon Cammen, New York
Address by Percy Longmuir, Institute of British Foundrymen—annual exchange paper
The Desulphurization of Cast Iron, by Richard Moldenke, Watchung, N. J.
Report of Committee on Corrosion of Cast Iron
Report of Committee on Pattern Standardization

Thursday, May 3

Steel Foundry Practice

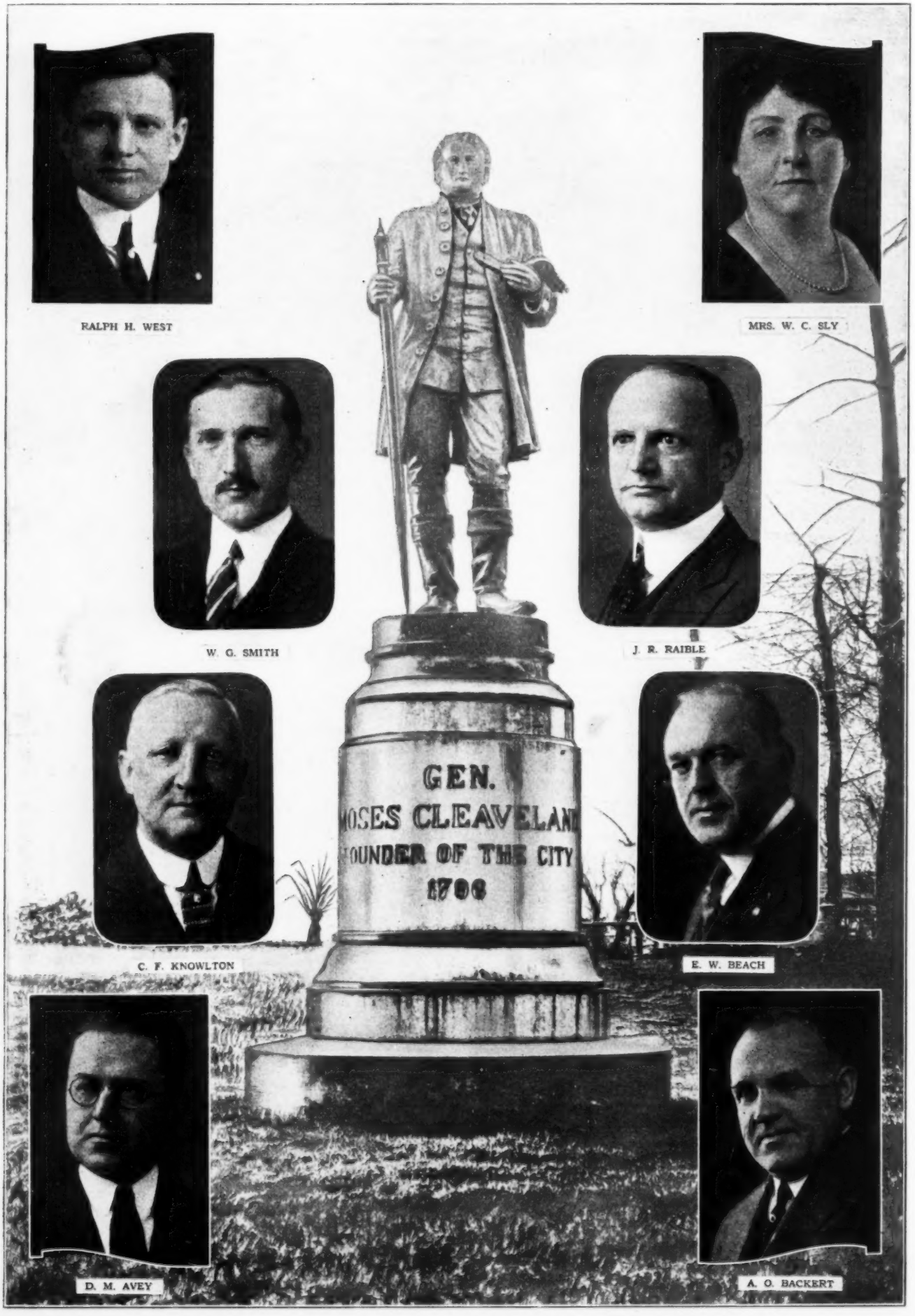
9:30 a. m.—Heat Treatment of Alloy Steel Castings, by H. A. Lorenz, Bucyrus Co., South Milwaukee, Wis.
Annealing Steel Castings, by H. A. Neel, Michigan Steel Casting Co., Detroit
Core Mixtures for Light Steel Castings, by C. S. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa.
Report of Committee on Refractories
Report of Committee on Heat Treatment of Ferrous Castings

Gray Iron Session

9:30 a. m.—Notes on Gray Iron for Automotive Castings, by H. B. Swan, Cadillac Motor Car Co., Detroit
Carbon in Cast Iron, by J. W. Bolton, Niles Tool Works Co., Hamilton, O.
Report of Committee on Specification for Cast Iron
Visual Observation of Melting in a Cupola, by John Grennan, University of Michigan, Ann Arbor, Mich.

New Developments in the Foundry Industry

2:00 p. m.—Gray Cast Iron from the Point of View of the Electric Furnace, by G. K. Elliott, Lunkenheimer Co., Cincinnati.
The Electric Furnace from the Manager's Standpoint, by L. F. Barton, New Orleans, La.
Manufacture of Synthetic Foundry Iron in the Electric Furnace, by C. E. Sims, C. E. Williams and B. M. Larsen, Northwest experiment station, United States bureau of mines, Seattle.
A New Long Life Mold Development, by Richard Moldenke, Watchung, N. J.



EARLY IN MARCH A LOCAL FOUNDRYMENS COMMITTEE ON ARRANGEMENTS WAS APPOINTED TO PROVIDE ENTER-

almost since its inception as an industrial community. A 30-ton schooner was built at the mouth of the Cuyahoga in 1808 and six years later a second schooner twice as large as the first was launched at the same place. The first successful screw propeller steam vessel on the Great Lakes, appropriately named the EMIGRANT was built here and all the machinery and metal equipment used in its construction was fabricated in the foundry and machine shop of the Cuyahoga Steam Furnace Co.

Today, 600 large freight carriers ply the waters of the Great Lakes. Out of the 440 flying the American flag, approximately 75 per cent are owned in or managed from Cleveland. Nearly 8,000,000 tons of iron ore from the Minnesota iron ranges arrived by boat in the city in 1920 and in the same time nearly 1,500,000 tons of coal were shipped to western lake ports. In addition to vast quantities of lumber and other building material, nearly 10,000,000 bushels of grain were unloaded at Cleveland docks in the same year. Out of the 58,634,540 tons of iron ore shipped from upper lake ports in 1920 nearly 8,000,000 tons were delivered in the city and a total of nearly 24,000,000 tons were unloaded in the Cleveland district including Ashtabula, Conneaut, Fairport, Lorain and Huron.

One third of the iron ore unloaded on Cleveland docks is converted into pig iron in twelve blast furnaces and more than half of this pig iron is afterward employed in the production of steel for rolling, or for gray iron and malleable castings for steel ships, wire and its many adaptations, bolts and nuts, heavy machinery, automobile parts, machine tools, vehicle hardware and practically every form in which steel or iron is employed.

Hoisting and conveying machinery made in Cleveland may be seen in every industrial country of the world where ore is mined or where it is reduced to its metallic form. Whistling jets of steam from Brown-Hoist and McMyler-Interstate cranes punctuate the day's work in Alaska; high up in the Cordilleras of South America and in the African Rand. The calloused hands of a native Chinese laborer are as familiar with the electric controlling levers on a Brown bridge serving a blast furnace in Hankow, China, as are those of his white brother handling a similar device in Sydney, Nova Scotia, or in the home town of its maker designated on the name plate as Cleveland, Ohio, U. S. A.

Charging machines, water cooled reversing valves and other devices responsible in great measure for the advance in open-hearth steel melting practice in recent years are made by the Wellman-Seaver-Morgan Co. The manner of handling bulk freight, particularly iron ore and coal, on the lakes was revolutionized by the late S. T. Wellman when he developed a machine that picks up gondolas loaded with coal and dumps the

Cleveland Entertains Foundrymen

Executive Committee

Ralph H. West, chairman	West Steel Casting Co.
A. O. Backert	Penton Publishing Co.
E. W. Beach	Ferro Machine & Foundry Co.
J. R. Raible	Fanner Mfg. Co.
C. F. Knowlton	Westinghouse Electric & Mfg. Co.
Mrs. W. C. Sly	15426 Lake Avenue, Lakewood, O.
Werner G. Smith	Werner G. Smith Co.
D. M. Avey	THE FOUNDRY.

Finance Committee

A. O. Backert, chairman	Penton Publishing Co.
William B. Greene	Acme Palmer & DeMooy Foundry Co.
Werner G. Smith	Werner G. Smith Co.
S. C. Vesey	W. W. Sly Mfg. Co.

Reception Committee

E. W. Beach, chairman	Ferro Machine & Foundry Co.
Henry Behr	Paralite Co.
J. J. Bever	Otis Steel Co., Ltd.
Fred Blundell	Taylor & Boggis Foundry Co.
B. F. Braum	Born Steel Range Co.
C. W. Brennan	Royal Brass Mfg. Co.
T. J. Calhoun	Johnston & Jennings Co.
C. M. Campbell	Pioneer Alloy Products Co.
J. A. Cochrane	J. A. Cochrane Brass Mfg. Co.
E. S. Cohen	Stoney Foundry Engineering & Equip. Co.
A. T. Dexter	National Malleable Castings Co.
Ralph Ditty	Federal Foundry Supply Co.
Clarence Frantz	Apex Electrical Mfg. Co.
D. J. Gluntz	Gluntz Brass Mfg. Co.
H. E. Gresham	Ohio Steel Castings Co.
George Hammink	City Brass Foundry Co.
H. B. Harsch	John Harsch Bronze & Foundry Co.
C. R. Hays	General Bronze Foundry Co.
Charles Herbolt	Ohio Foundry Co.
R. S. Hoffman	Hoffman Bronze & Aluminum Castings Co.
E. J. Kortan	K. & M. Brass & Aluminum Cast's Co.
D. A. Leahy	Empire Brass Mfg. Co.
F. W. McCormack	Cleveland Brass Mfg. Co.
M. W. Merriam	Madison Foundry Co.
S. J. Mikat	Aluminum Manufacturers, Inc.
Charles Miles	Aetna Brass Mfg. Co.
Percy Mooren	Meech Foundry Co.
W. Nachtigall	Crucible Steel Castings Co.
J. E. O'Brien	Fanner Mfg. Co.
F. J. Opatrny	Cuyahoga Foundry Co.
B. R. Pearse	Atlas Foundry Co.
Charles A. Prockaska	Eberhard Mfg. Co.
P. Richards	Republic Brass Co.
J. Schmeller	National Bronze & Aluminum Foundry Co.
H. H. Schneider	Standard Car Wheel Co.
Albert Schraner	A. P. Schraner
C. F. Schultis	United Brass Mfg. Co.
Frank Schuman	Interstate Foundry Co.
John T. Stoney	Ferro Machine & Foundry Co.
P. J. Strangward	Forest City Foundry & Mfg. Co.
W. J. Strangward	Walworth Run Foundry Co.
William Streigel	Russ Mfg. Co.
M. J. Sweeney	Allyne-Ryan Foundry Co.
W. F. Swift	City Foundry Co.
R. S. Tyler	Chandler & Price Co.
H. G. Wellman	Wellman Bronze Co.
W. S. Wellman	Wellman Products Co.
J. W. Wilbur	Motor Patterns Co.
F. H. Zwilling	Ideal Bronze Co.

Entertainment Committee

J. R. Raible, chairman	Fanner Mfg. Co.
A. O. Backert	Penton Publishing Co.
A. H. Chappelka	Chisholm & Moore Mfg. Co.
F. A. Coleman	F. A. Coleman & Co.
Ralph Ditty	Federal Foundry Supply Co.
W. R. DuRoss	Russ Mfg. Co.
Charles W. Hotchkiss	National Malleable Castings Co.
Henry Molder	Best Foundry Co.
J. H. Redhead	Reliance Trust Co.
M. C. Rosenfeld	Grabler Mfg. Co.
J. S. Smith	Smith Facing & Supply Co.
P. J. Strangward	Forest City Foundry & Mfg. Co.
A. J. Tuscany	Ohio State Foundrymen's association
G. H. Wadsworth	Wadsworth Core Machine & Equipment Co.

Plant Visitation Committee

C. F. Knowlton, chairman	Westinghouse Electric & Mfg. Co.
J. S. Smith	Smith Facing & Supply Co.
J. T. Stoney	Ferro Machine & Foundry Co.
M. J. Sweeney	Allyne-Ryan Foundry Co.
F. B. Whitlock	Interstate Foundry Co.

Ladies Reception Committee

Mrs. W. C. Sly, Chairman	Mrs. James Mitchell
Mrs. D. M. Avey	Mrs. J. R. Raible
Mrs. A. O. Backert	Mrs. Werner G. Smith
Mrs. C. M. Bolich	Mrs. John T. Stoney
Mrs. A. H. Chappelka	Mrs. P. J. Strangward
Mrs. A. Gerdum	Mrs. G. H. Wadsworth
Mrs. Maud Sly Hoffman	Mrs. R. H. West
Miss Eleanor Knowlton	Mrs. M. W. Zeman
Mrs. Robert Krebs	

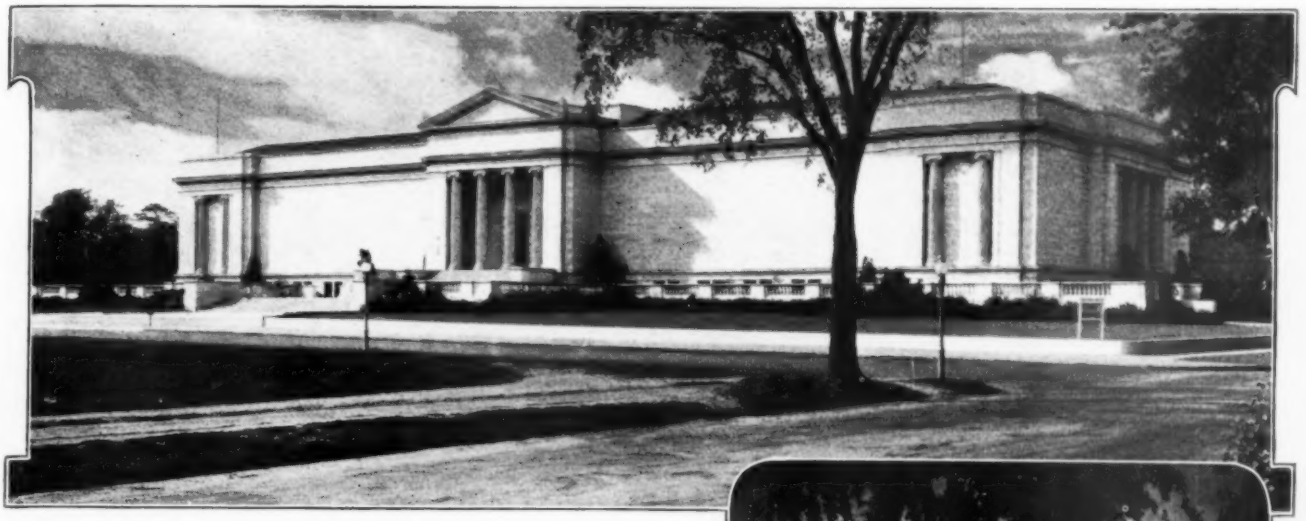
Golf Committee

Werner G. Smith, chairman	Werner G. Smith Co.
A. H. Chappelka	Chisholm & Moore Mfg. Co.
B. R. Pearse	Atlas Foundry Co.
D. J. Ryan	Allyne-Ryan Foundry Co.
S. P. Schless	Superior Foundry Co.
J. H. Bruce	Bowler Foundry Co.
M. J. Sweeney	Allyne-Ryan Foundry Co.
W. F. Swift	City Foundry Co.

Publicity Committee

D. M. Avey, chairman	THE FOUNDRY
C. A. Barnett	Foundry Equipment Co.
O. D. Conover	Austin Co.
F. W. Klatt	W. W. Sly Mfg. Co.
Donald Payne	Osborn Mfg. Co.
F. L. Prentiss	Iron Age Publishing Co.

LEADING FOUNDRYMEN, MANUFACTURERS OF FOUNDRY EQUIPMENT AND SUPPLIES, AND IN FACT ALL OF THE CLEVELAND FOUNDRY WORLD IS INTERESTED IN THE CONVENTION



CLEVELAND'S BEAUTIFUL ART MUSEUM WILL FORM THE CENTRAL FEATURE OF THE LADIES' ENTERTAINMENT PLANNED FOR TUESDAY

contents into a waiting freighter at the rate of one a minute. Material is unloaded from the boats almost as rapidly by two types of unloading devices, one credited to S. T. Wellman and the other to S. H. Hulett. Four of the latter machines working in unison on the dock at Conneaut, O., established a world's record on Sept. 12, 1921, when they whipped 12,507 tons of iron ore out of the steamer D. G. KERR in 3 hours and 5 minutes.

On March 22, 1898, Alexander Winton sold the first gasoline propelled automobile made in Cleveland and one of the first produced in the United States. Winton cars still are made in the city and in addition nine other factories are engaged in the production of automobiles. Over 100,000 machines are owned and driven in the city.

Cleveland is the birthplace of the Standard Oil Co., where the first crude petroleum was refined in 1859. Discovery of western and southern oil fields and other economic factors have taken away the city's leadership in this industry, but several great refineries still are operated to the tune of over 100,000,000 gallons of petroleum products annually. Half of the city's industrial production is bound up with iron and steel, but other important lines include the manufacture of paints and varnishes, woolen cloth, clothing, paving brick, building material and electrical devices and appliances.

The first successful test of electric street lighting was tried in the Cleveland public square by the inventor C. F. Brush. Today more than 80 per cent of the nation's electric carbons are made in the city's factories. The headquarters, general offices and great laboratories of the world's greatest makers of electric lights are located here. The city also is a leading producer of electric batteries, generators, fans, trucks, vacuum cleaners and electrically operated machinery of every description.

One of the earliest bessemer converters in the United States was blowing rail steel in 1868 in the plant of the Cleveland Rolling Mills Co., Newburg, now one of the component units making up the American Steel & Wire Co. The glare from two 15-ton converters still lights up the vicinity by day and night and in addition the company operates five 75-ton and two 50-ton basic open hearth furnaces. Hot metal for these various steel producing units is furnished by a group of five blast furnaces located several miles away on the Cuyahoga river where the cargo from the ore boats is discharged directly upon stock piles.

The oldest available records on the casting industry would seem to indicate that John Ballard & Co., started

The Daily Foundry

NEWS covering the exhibition and convention of the American Foundrymen's association and related technical organizations will be chronicled in a daily edition of THE FOUNDRY *to be published April 30, May 1, 2 and 3. This full-size newspaper will present up-to-the-minute features of interest to those attending the convention, announcements of all special events of the day, and items of personal interest including the activities of the different technical sessions. An alphabetical list of members and visitors registered at headquarters will be published. This will include a notation denoting the hotel at which each person is situated and thus one may locate friends and acquaintances who are present. The daily edition of* THE FOUNDRY *will be distributed widely with the compliments of the Penton Publishing Co., Cleveland, and all in attendance are invited to avail themselves of any of its facilities.*

HOSPITALITY IS THE WATCHWORD OF CLEVELAND FOUNDRYMEN WHO EXPECT TO ENTERTAIN MANY VISITORS THE WEEK OF APRIL 30

a foundry in 1828 about 30 years after the city was founded. The Cuyahoga Steam Furnace Co., incorporated March 3, 1834, with a capital of $100,000 advanced by Charles Hoyt, Richard Lord, Hosiah Baker and others was the first company engaged in a general foundry business to be chartered under state law. The size and importance of this establishment may be inferred from the fact that a time when the total population of the town

was only 3323, it employed 100 men and produced 500 tons of castings a year. Pig iron was brought from Dover 12 miles to the west.

In addition to the ordinary run of work common to all jobbing foundries the plant made cannon for the government in 1841 and afterward went into the manufacture of railroad construction machinery and locomotives. The first locomotive built west of the Allegheny mountains for service on the Detroit and Pontiac railway was built here. Reference already has been made to the fact that the EMIGRANT, the first successful screw propelled steamboat on the Great Lakes was built at this plant.

Four iron foundries were listed when the city's first directory was issued in 1837. In 1856 a few far-sighted men visualizing the city as a center for the manufacture of iron products raised about $60,000 and offered the city to establish a blast furnace. Previous to this, in 1852 William A. Otis and J. M. Ford formed a partnership to manufacture iron castings.

Entertainment Offered by Cleveland

Monday Morning, April 30

Shopping tours under direction of experienced department store guides have been arranged to follow immediately after ladies' registration.

Tuesday Morning, May 1, 9 a. m.

Automobiles will be provided to take contestants to the Country Club for a blind handicap golf tournament and lunch.

Tuesday, May 1, 11:00 a. m.

Automobiles will be provided to leave a designated point for a sight-seeing tour terminating at the Wade Park manor where luncheon will be served. This will be followed by an inspection of the Cleveland museum of art near by, which is one of the most beautiful structures in the country devoted to this purpose and which houses an exceptionally fine collection of paintings, statuary, textiles, arms, china, etc. An organ concert will be featured, followed by a sight-seeing tour terminating at the starting point.

DELIGHTFUL DRIVES ALONG SHADY BOULEVARDS, GOLF, THEATERS, TEAS, LUNCHEONS AND CONCERTS WILL CHARACTERIZE THE ENTERTAINMENT FEATURES

Tuesday, May 1, 8:15 p. m.

The entire Keith's Palace theater has been leased by the Cleveland committee for the evening, and a special vaudeville program will be offered through the courtesy of the management. Opportunity will be given all guests to inspect the backstage section of the theater and music will be provided for a dance to be held on the stage after the performance.

Wednesday, May 2, 11:30 a. m.

Automobiles will be provided to leave a designated point. A sight-seeing trip through the western part of the city will terminate at one of the handsome Lake Shore clubs, where a card party will be held and a light luncheon served. Automobiles will be provided to return the guests to the down-town section.

Wednesday, May 2, 7 p. m.

The annual subscription banquet of the American Foundrymen's association will be held at the Hotel Cleveland. Immediately following a reception and dance will be given, at which those in attendance will be the guests of the Cleveland committee.

During the entire week many of Cleveland's leading foundry industries will hold open shop, and formal plant visitations have been arranged. Full directions for plant visitation will be available on registration.

Arrangements have been made at practically all Cleveland's exceptional golf courses for visitors at the convention to indulge in the pastime. The golf committee requests that those who expect to play bring their own clubs, shoes and other necessary paraphernalia. Visitors should bring cards from their home golf clubs.

The firm later became Otis & Co., then the Lake Erie Iron Co., the Otis Iron & Steel Co. and finally the Otis Steel Co. which still maintains a steel foundry, although its present principal activity at its two plants is the manufacture of rolled steel products.

The Cleveland Foundry was another early venture. It was started by Bowler & Maher. In 1866 Hovey Taylor & Son started a foundry busi-

ness which has endured to the present time. The firm has been known for many years as Taylor & Boggis, operating two foundries on light castings, one at the old stand on West Third street and a comparatively new foundry on East Fifty-fifth street.

Foundries and machine shops employed 40 per cent of all men engaged in the metal working industry in 1909 and in this respect the castings industry ranked first. During the war over 6000 men were employed in the foundries alone.

The right to the title of City of Varied Industries has been proved in Cleveland by the way in which its manufacturing plants resisted the business depression just past. A few lines of manufacture suffered severly, but others maintained operation and therefore a fair measure of activity was sustained over the entire city industrial field. This is in interesting contrast with conditions obtaining elsewhere. For example when the textile demand dropped in the east, foundries engaged on that class of work in those

MRS. R. E. KREBS

B. R. PEARSE

MISS ELEANOR KNOWLTON

MRS. J. T. STONEY

C. M. CAMPBELL

CHARLES MILES

F. J. OPATRNY

E. S. COHEN

J. E. O'BRIEN

H. H. SCHNEIDER

PLANT VISITATION ALWAYS A SOURCE OF INFORMATION AND PLEASURE WILL RECEIVE PARTICULAR ATTENTION DURING THE FOUNDRYMEN'S WEEK IN CLEVELAND

cities were automatically closed. When the buyers' strike extended to a point where automobile sales were included many middle western factories engaged solely in automobile production suspended operation. Cessation of machine tool demand closed many foundries in districts where these machines are made exclusively.

The variety of sources from which Cleveland draws its orders carried the foundry business over the recent depression on a better basis perhaps than in any other city in the country. When the demand for machine tool and automobile castings fell off, cast iron pipe shops were busy and the same is true of car wheel shops and others engaged in the manufacture of stoves and heaters, plumbers' supplies and miscellaneous castings required in building construction.

In the number of plants engaged in the manufacture of castings Cleveland with 117 stands fourth in the list of American cities. In the period between 1920 and 1922 it exchanged places with Detroit where expansion in the automobile industry automatically increased the number of foundries specializing in the production of castings for pleasure cars and trucks.

In a city engaged so extensively in the foundry business it is natural to find many establishments devoted to the manufacture of foundry supplies and equipment. Every single item required in the erection, operation and maintenance of a foundry designed for the production of castings either in ferrous or nonferrous metals is made here. Doubtless to many foundrymen, past, present or future customers, the opportunity afforded by this convention for visiting the plants of these manufacturers will prove the most satisfactory feature of the gathering.

The city ranks high in the iron and steel industry; it is an important foundry center, and as a direct result of these contributing factors it enjoys a commanding position in the manufacture of foundry equipment and supplies. Everything needed in the operation of a modern castings manufacturing plant can be secured in the city or in the immediate district surrounding Cleveland. Sand handling and conditioning equipment, cranes, hoists, trucks, molding machines, melting furnaces, core ovens, tumbling mills, sand blast installations, dust arrester and conveying equipment and complete foundry buildings form a few of the manufacturing units which Cleveland manufacturers can supply to foundries.

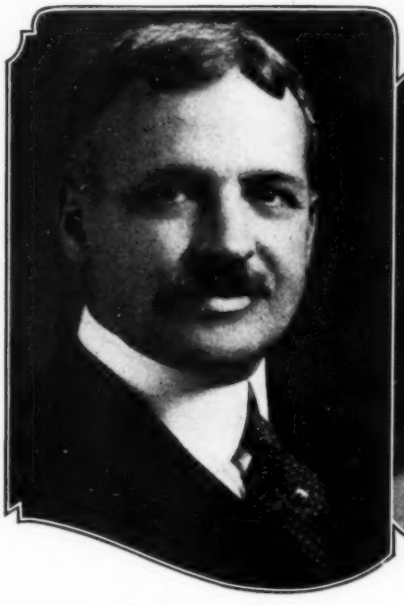
Notable progress has been made in the types of construction followed in building foundry structures, during the past few years. The idea of corodinating the building and accodating it to the equipment employed, in other words, applying engineering prinicples to foundry construction has been developed and advanced through the active assistance of Cleveland construction firms. The unit type of building, capable of being quickly assembled, and expanded to meet growing needs has found wide acceptance. Many foundries of this type have been built throughout the country by Cleveland engineers and construction companies.

Foundry supplies made in Cleveland include core oils, brushes, facings and partings, nails and chaplets. It is interesting to note that pabably 60 per cent of the chaplets made in the country are produced by firms with Cleveland plants.

Several features mark the approaching exhibition as exceptional. Although the Cleveland exhibit was not advertised extensively, more applications for space were received than could be accommodated. In a spirit of helpfulness, many of the older exhibitors willingly curtailed their own requirements to permit others to share in the exposition. The entire exhibition hall, stage, corridors, and the auditorium proper, of the $6,500,000 Cleveland public hall will be crammed with exhibits of machinery, equipment, and supplies.

A local foundrymen's committee on arrangements was organized early in March, and this committee comprising Cleveland foundrymen, manufacturers of equipment, machinery and supplies, has been busy arranging for the reception and entertainment of the city's guests in the week from April 28 to May 3. Ralph H. West, president, West Steel Casting Co., is chairman of the Cleveland committee and has had personal direction of the various features planned. Special arrangements have been made for plant visitation, golf tournaments, theater parties, dances and parties for the ladies.

Head Associations Meeting in Cleveland



FRANKLIN G. SMITH
President Foundry Equipment Manufacturers' Association

F. R. FAUNTLEROY
President American Malleable Castings Association

C. R. MESSINGER
President American Foundrymen's Association

Representative Foundries of the Convention City

Location, Personnel and Capacity of Cleveland Casting Plants

Name	Address	Established	Metal melted	Class of castings	Output daily, tons	Melting units	No. men employed	President or general manager
Acme-Palmer & DeMooy Foundry	5217 Sweeney Ave.	1900	Gray iron	Light	15	60-inch cupola	200	W. B. Greene
Aetna Brass Mfg. Co.	1635 E. 55th St.	1901	Brass, aluminum	Jobbing and patterns	5	5 oil furnaces	60	Charles Miles
Allyne-Ryan Foundry Co.	Aetna Road at E. 91st St.	1913	Gray iron	Automobile	150	2 84-inch cupolas	1000	D. J. Ryan
American Shipbuilding Co.	Foot W. 54th St.	1899	Gray iron, brass	Marine castings	10	2 cupolas	40	A. G. Smith
Arth Brass & Aluminum Casting Co.	1372 E. 33rd St.	1914	Brass, bronze & alum.	Jobbing and plumbing	2	2 oil furnaces	18	Mrs. M. Arth
Atlas Foundry Co.	Shaw Ave. and Big. Four R. R.	1913	Gray iron and semisteel	Jobbing	15	68-inch cupola	50	B. R. Pearse
Borne Steel Range Co.	3945 W. 25th St.	1891	Gray iron	Stove plate	30	48 and 66-in. cupolas	75	H. G. Born
Bowler Foundry Co.	1688 Columbus Road	1862	Gray iron	Jobbing	40	60-inch cupola	250	J. H. Bruce
Broadway Foundry Co.	8025 Franklin Ave.	1896	Gray iron	Jobbing	10	54-inch cupola	75	E. C. Fleischman
Buckeye Brass & Mfg. Co.	6410 Hawthorne St.	1912	Brass	Jobbing	8	6 double oil furnaces	150	J. J. Allmendinger
Carlin Co., Anthony	2717 E. 75th St.	1888	Gray iron	Jobbing	25	78-inch cupola	75	Anthony Carlin
Central Brass Mfg. Co.	6119 Cedar Ave.	1895	Brass	Part of industrial plant	2	Oil pit furnaces	50	E. A. Eckhouse
Chandler & Price Co.	6000 Carnegie Ave.	1911	Gray iron	Machinery	20	42 and 54-inch cupolas	150	R. S. Tyler
City Brass Foundry Co.	5310 St. Clair Ave.	1905	Brass and aluminum	Jobbing	5	7 oil furnaces	90	George Hammink
City Foundry Co.	4629 Hamilton Ave.	1890	Gray iron	Jobbing	30	72 and 60-inch cupola	190	W. F. Swift
Chisholm & Moore Mfg. Co.	5046 Lakeside Ave.	1897	Malleable	Part of industrial plant	35	3 air furnaces	500	S. H. Moore
Cleveland Aluminum Casting Co.	901 Addison Road	1912	Brass and aluminum	Jobbing	3	4 oil, 6 coke furnaces	35	James W. Tovell
Cleveland Co-operative Stove Co., Plant No. 1	Central Ave. at E. 67th St.	1867	Gray iron	Stoves	120	Four 84-inch cupolas	1500	James Mitchell
Plant No. 2	2818 Harvard Ave.							
Crucible Steel Casting Co.	Almira and W. 84th St.	1909	Steel	Jobbing	8	Electric furnace	120	H. L. Aiken
Cuyahoga Foundry Co.	4530 E. 71st St.	1920	Gray iron	Jobbing	35	84-inch cupola	120	Frank J. Opatrny
Eberhard Mfg. Co.	2734 Tennyson Road	1881	Malleable	Stock goods	40	7 air furnaces	1200	H. P. Champney
Electric Vacuum Cleaner Co.	Ivanhoe Road	1910	Aluminum and brass	Part of industrial plant	2½	4 furnaces oil	75	J. Tuteur
Empire Brass Mfg. Co.	10301 Berea Road	....	Brass	Plumbers' goods	2	8 coke furnaces	20	L. A. Deutsch
Farnan Brass Works Co.	1104 Center St.	1852	Brass	Plumbers' goods	1	Coke furnaces	20	S. Resek
Ferro Machine & Foundry Co.	E. 66th and Hubbard Ave.	1900	Gray iron	Automobile	200	3 72-inch cupolas	675	E. W. Beach
Forest City Foundry & Mfg. Co.	1220 Main St.	1890	Gray iron	Jobbing	35	84-inch cupola	160	P. J. Strangward
Fulton Foundry & Machine Co.	E. 75th and Morgan Ave.	1898	Gray iron	Jobbing	20	66-inch cupola	200	Carl F. Mead
Globe Brass Mfg. Co.	5532 Perkins Court	1907	Brass	Jobbing	1½	3 oil furnaces	30	H. F. Albers
Grabler Mfg. Co.	6565 Broadway	1910	Malleable	Plumbers' goods	25	2 air furnaces, cupola	300	M. S. Bayer
Hammond Metal Products Co.	2703 Orange Ave.	1920	Brass and aluminum	Jobbing	1½	3 oil furnaces	25	H. R. Hammond
Harsch Bronze & Foundry Co.	11612 Madison Ave.	1914	Nonferrous	Jobbing	5	17 furnaces	100	John Harsch
Hill Clutch Co.	W 65th and Breakwater Ave.	1884	Gray iron	Jobbing	20	54-inch cupola	150	Harry J. Smith
Hoffman Bronze & Aluminum Casting Co.	1000 Addison Road	1918	Brass, bronze & alum.	Jobbing	2	8 furnaces	50	Robt. S. Hoffman
International Permold Co.	6800 Grant Ave.	1921	Aluminum	Jobbing	..	..	..	J. B. Chaffe Jr.
Interstate Foundry Co.	E. 61st near Erie railroad	1900	Gray iron and steel	Jobbing	160	Cupolas and converter	1500	F. B. Whitlock
Kayline Co.	600 Huron Road	1895	Brass	Part of industrial plant	½	Oil furnace	10	B. F. Klein
Kilby Mfg. Co.	Lakeside Ave. at 49th St.	1888	Gray iron	Stock and jobbing	25	48 and 72-inch cupolas	140	J. H. Francis
Leader Brass Foundry & Mfg. Co.	3309 Jennings Road	1913	Brass	Plumbers' goods	2	3 coke furnaces	20	H. J. Fuhr
L. N. N. Foundry Co.	2088 Scranton Road	1918	Gray iron	Jobbing	5	40-inch cupola	45	Max Green
Madison Foundry Co.	935 Addison Road	1898	Gray iron	Jobbing	25	84-inch cupola	175	George Walton
Meech Ave. Foundry Co.	9906 Meech Ave.	1921	Gray iron	Jobbing	3	36-inch cupola	20	P. R. Mooren
Monarch Aluminum Ware Co.	4613 Payne Ave.	1913	Aluminum	Jobbing	..	..	..	R. Deutsch
Motor Pattern Co.	E. 61st and Waterman Ave.	1919	Aluminum and brass	Jobbing	..	..	2	John W. Wilbur
National Bronze & Aluminum Foundry Co.	E. 88th and Laisy Ave.	1908	Brass and aluminum	Jobbing	75	30-pit—5 reverberat'y	350	John Schmeller
National Car Wheel Co.	2120 W. 106th St.	1910	Gray iron	Car wheels	100	72-inch cupola	65	H. E. McClumpha
National Malleable Castings Co.	Quincy and Woodhill Road	....	Malleable	Railway, Auto, Tractor	75	2 cupolas, 2 elec. furnaces, converter	900	Chester K. Brooks
Nickel Plate Foundry Co.	14915 Woodworth Road	1919	Gray iron	Jobbing	20	48-inch cupola	100	C. M. Bolich
Ohio Foundry Co. Plant No. 1	E. 71st and Stanton Ave.	1893	Gray iron	Jobbing	40	2 84-inch cupolas	350	H. N. Longfield
Ohio Foundry Co. Plant No. 2	9608 Quincy Ave.	1893	Gray iron	Jobbing	50	2 86-inch cupolas	350	Chas. Herbold
Ohio Steel Castings Co.	2284 Scranton Ave.	...	Steel	Jobbing	5	Converter	60	Geo. Martin
Parker Street Castings Co.	Garfield Heights	1922	Gray iron	Jobbing	10	64-inch cupola	50	H. R. Street
Peck, Stow & Wilcox Co.	2176 West 3rd St.	1880	Gray iron and brass	Part industrial plant	7½	48-inch cupola	70	O. J. Blank

Representative Foundries of the Convention City

LOCATION, PERSONNEL AND CAPACITY OF CLEVELAND CASTING PLANTS

Names	Address	Established	Metal melted	Class of castings	Output daily, tons	Melting units	No. men employed	President or general manager
Proof Machine & Foundry Co.	936 E. 72nd St.	1917	Brass, bronze & alum.	Jobbing	3	4 oil and 3 coke fur	50	James Plachy
Royal Brass Co.	1418 E. 43rd St.	1906	Brass	Plumbers' goods	1½	5 coke furnaces	15	C. W. Brennan
Standard Brass Foundry Co.	988 E. 67th St.	1900	Brass and aluminum	Jobbing	8	Oil and coke furnaces	80	A. J. Bloom
Standard Car Wheel Co.	6704 Bessemer Ave.	1896	Gray iron	Car wheels	125	72 and 36-inch cupolas	110	H. J. Schneider
Sterling Brass Co.	9600 St. Catherine Ave.	1907	Brass	Plumbers' goods	3	3 oil furnaces	30	S. L. Weil
Superior Foundry Co.	E. 71st & W. & L. E. railroad	1893	Gray iron	Jobbing	250	7 cupolas	1400	G. J. Feiss
Taylor & Boggis Foundry Co.	1913 W. 3rd St.	1866	Gray iron	Jobbing	20	54-inch cupola	75	J. A. Parker
Taylor & Boggis Foundry Co. Plant No. 2	3027 E. 55th St.	....	Gray iron	Jobbing	40	84, 1 60-inch cupola	125	J. A. Parker
Walworth Run Foundry Co.	2488 W. 27th St.	1893	Gray iron	Jobbing	30	2 72-inch cupolas	300	W. J. Strangward
Wellman Bronze Co.	6017 Superior Ave.	1910	Brass and aluminum	Jobbing	5	Coke and oil furnaces	100	F. S. Wellman
Wellman-Seaver-Morgan Co.	7000 Central Ave.	1902	Steel	Part industrial plant	25	2 20-ton open-h'th fur.	300	E. S. Church
Westinghouse Electric & Mfg. Co.	West 58th St.	1898	Gray iron	Part of industrial plant	100	8 cupolas	1350	C. F. Knowlton
West Steel Casting Co.	805 E. 70th St.	1906	Steel	Jobbing	15	32 and 36-inch cupolas; 2 2-ton converters; 3-ton electric furnace	300	R. F. West
Woodhill Brass Co.	2889 Woodhill Road	1920	Brass	Jobbing	1	Oil furnace	15	Frank R. Noss

Exhibits Will Show Wide Diversity

ABRASIVE INDUSTRY, Cleveland.—This booth will be fitted up as a rest room where those in attendance are invited to make their headquarters. Represented by F. B. Jacobs, Herbert R. Simonds, George B. Howarth, A. M. Pulaski, H. Linton and B. K. Price.

AIR REDUCTION SALES CO., New York. This company will feature specially designed machines for automatic oxyacetylene cutting, in addition the use of hand welding and cutting torches on gray iron and steel castings will be demonstrated. There also will be a display of oxygen and acetylene cylinders, and the various units of apparatus manufactured by the company. Represented by J. L. Anderson, F. E. Rogers, Alexander Blaser, C. E. Hobbs and G. Van Alstyne.

AJAX METAL CO., Philadelphia.—This company will exhibit ingot metals, specimen castings, and alloys for babbitting; also electric furnaces of the Ajax Wyatt and Ajax Northrup types. Representatives are to be G. H. Clamer, W. J. Coane, F. M. Willeson, Zeno D. Barnes, D. H. Fairfield and Henry Gieseke.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—A reception room in charge of M. J. Slater and L. Murray will be maintained by this company.

ALLAN MFG. & WELDING CO., INC., Buffalo.—An electric welding outfit and portable internal power grinders may be seen at this booth which will be in charge of A. H. Yohannan.

AMERICAN FOUNDRY EQUIPMENT CO., New York.—This company's exhibit will include sand cutting machines for large sand heaps and for light sand heaps. A sand-blast room with a new down draft system of ventilation equipped with a pedestal type rotary table will also be shown. Other sand-blast equipment to be exhibited includes a sand-blast pressure tank and cloth-screen dust arrester. A number of different types of molding machines and a core machine together with a miscellaneous exhibit of snap flasks, pattern frames, mounting compound, etc., also will be exhibited. Represented by V. E. Minich, E. A. Rich, H. H. Haley, R. H. Kelley, James Rigby Jr., C. D. Steinmeier, J. E. Sweet, J. D. Alexander, C. B. Schneible, C. G. Smith, F. A. Smith, E. J. Turnbull, S. H. Baird, R. H. Moore, David Logan, and P. S. Wiener.

AMERICAN HOMINY CO., Chicago.—Samples of core oil will be shown with a display of cores made with the company's bonding materials, and also castings in which these cores were used. Represented by R. H. Mills, W. H. Albohn, John A. Green and A. N. Duncan.

F. C. ANDRESEN & ASSOCIATES, INC., Pittsburgh.

ARCADE MFG. CO., Freeport, Ill.—The pouring device manufactured by this company will be displayed together with several types of molding machines such as jolters, jolt squeezers and jolt strippers. L. L. Munn, Henry Tscherning, Mentor Wheat, August Christen, G. D. Wolfey, R. E. Turnbull, and J. A. Morgan will represent the company.

AREX CO., Chicago.—A demonstration of the pulling power of the stationary ventilating unit made by this company will be in operation, and photographs will show installations made in foundries. H. L. Foote, Thomas Batdorf and H. F. Thomas will represent the company.

ARMSTRONG-BLUM MFG. CO., Chicago.—This company will show metal band saws, power hack saw machines, an automatic high speed saw, a punching, shearing and bending machine, and a rod cutter, which will be in actual operation. Harry J. Blum will be in charge of the booth.

ARROW TOOLS, INC., Chicago.—Small tools such as are used in the foundry industry; principally hand and pneumatic chisels and cold cutters may be seen at this booth which will be in charge of Louis Groessl, H. E. Pollard, and N. W. Benedict.

ASBURY GRAPHITE MILLS, Asbury, Warren county, N. J.—This company's exhibit will be devoted entirely to graphite. The company will be represented by H. M. Riddle Jr., Jonathan Bartley and E. H. Thompson.

E. C. ATKINS & CO., Indianapolis.—A display of hand saws, patternmaker's saws hack saw frames, metal cutting saws, hot saws, cold saws, hack saw blades, etc. will be given. Represented by E. S. Norvell, A. Mertz, B. D. Tompson, Everett Green, and T. A. Carroll.

ATLAS CAR & FOUNDRY CO., Cleveland.—This company will show a storage battery locomotive.

THE AUSTIN CO., Cleveland.—This exhibit will be maintained for the purpose of displaying photographs and construction data for foundries including minute sketches of foundry layouts and typical construction details. The following will be in attendance at the booth: G. A. Bryant Jr., O. D. Conover, H. E. Stitt, C. F. Chard, H. L. Cornelison, A. H. Meyer, and R. E. Ward.

AUTOMATIC TRANSPORTATION CO., Buffalo.—This company's exhibit will include an elevating platform truck, a 3-wheel tractor and other truck models. The company will be represented by R. J. Mullholland, O. H. Goodsell, George J. Simons and Thomas Donahue.

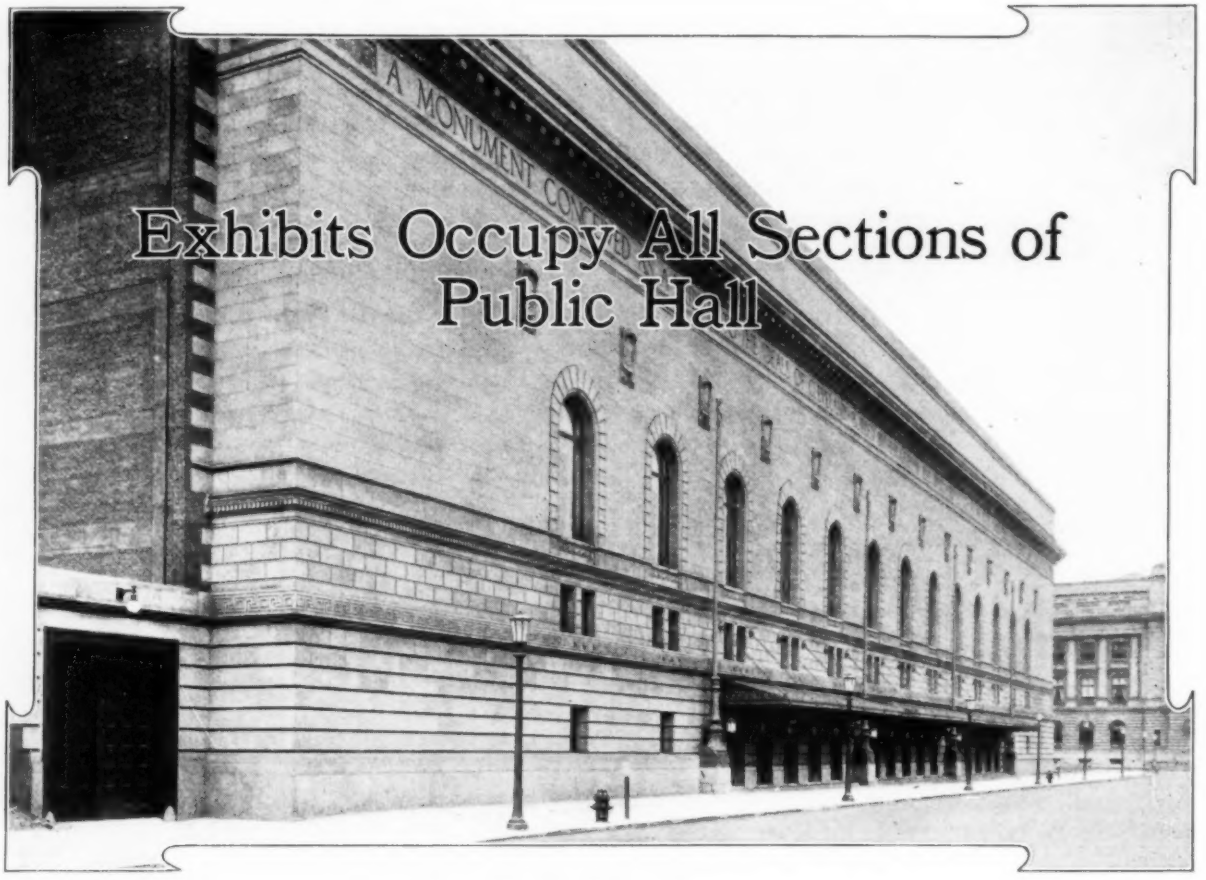
BACHARACH INDUSTRIAL INSTRUMENT CO., Pittsburgh.—New designs of pyrometers including a radiation pyrometer and several types of thermo-electric pyrometers will be exhibited by this company, together with pressure and volume gages. L. Vayda will be in charge of the exhibit assisted by A. C. Danks and C. B. Ashmead.

BALBACH METALS CORP., New York.—Samples of bars, ingots, pigs and shot of different metals and alloys will be shown, including solder, babbitt and anti-friction metals. James W. Paterson, F. Schmutzer, James MacNee Jr., R. H. Thomas and Thomas Thomson will represent the company.

C. O. BARTLETT & SNOW CO., Cleveland.—This company's exhibit will consist of sand handling equipment and mechanical carrying equipment for molds, cores and castings. H. L. McKinnon will be in charge of the booth assisted by H. C. Orr and S. Gertz.

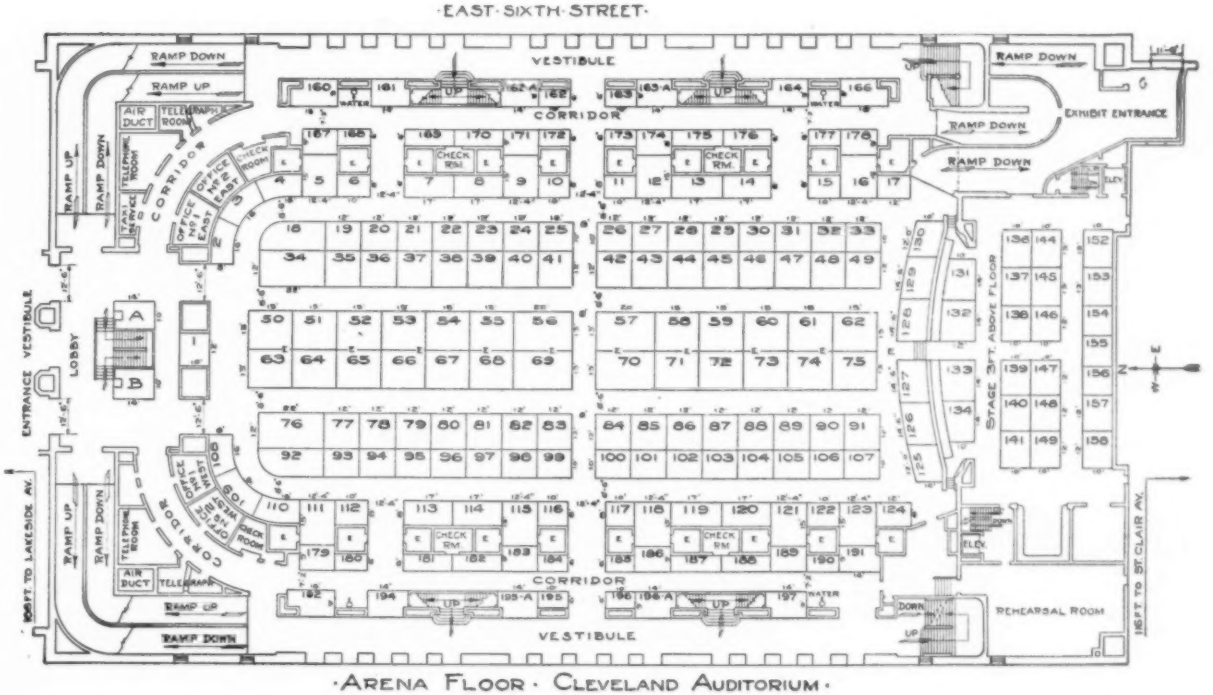
BEARDSLEY-PIPER CO., Chicago—Moving pictures showing different types of sand slingers in operation will be given by this company. Represented by E. O. Beardsley,

(Continued on Page 312)



Exhibits Occupy All Sections of Public Hall

Abrasive Industry ..... Arena
Air Reduction Sales Co. .. Exhib. Hall
Ajax Metal Co. ..... Arena
Albany Sand & Supply Co. ..... Arena
Allan Mfg. & Welding Co., Inc.. ..... Corridor
American Foundry Equipment Co. ..... Exhib. Hall
American Hominy Co. ..... Stage
F. C. Andresen & Associates, Inc. ..... Corridor
Arcade Mfg. Co. ..... Exhib. Hall
Arex Co. ..... Corridors
Armstrong-Blum Mfg. Co. .... Exhib. Hall
Arrow Tools, Inc. ..... Exhib. Hall
Asbury Graphite Mills ..... Arena
E. C. Atkins & Co. ..... Exhib. Hall
Atlas Car & Foundry Co. .....
Austin Co. ..... Arena
Automatic Transportation Co. ..... Arena
Bacharach Industrial Instrument Co. ..... Arena
Balbach Metals Corp. ..... Arena
C. O. Bartlett & Snow Co. ..... Arena
Beardsley-Piper Co. ..... Exhib. Hall
Berkshire Mfg. Co. ..... Exhib. Hall
Bethlehem Steel Co. ..... Arena
S. Birkenstein & Sons, Inc. ..... Arena
Black Diamond Saw & Machine Works ..... Arena
Blystone Mfg. Co. ..... Arena
Bonnot Co. ..... Arena
Bradley Washfountain Co. ..... Corridor
Brass World Publishing Co. ..... Arena
Bridgeport Safety Emery Wheel Co. ..... Exhib. Hall
British Aluminum Co., Ltd. ..... Arena
Buckeye Products Co. ..... Exhib. Hall
Campbell-Hausfeld Co. ..... Exhib. Hall
Carborundum Co. ..... Arena
Carter Bloxonend Flooring Co. .. Corridor
Frank D. Chase, Inc. ..... Arena
Chicago Crucible Co. ..... Arena
Chicago Pneumatic Tool Co. .. Exhib. Hall
Chisholm & Moore Mfg. Co. ..... Stage
Clark Tructractor Co. ..... Arena
Cleveland Armature Works .... Corridor
Cleveland Blow Pipe & Mfg. Co. ..... Corridor
Cleveland Crane & Engineering Co. ..... Exhib. Hall
Cleveland Flux Co. ..... Arena
Cleveland Pneumatic Tool Co. .. Exhib. Hall
Cleveland Steel Tool Co. .... Corridor
Cleveland Wire Spring Co. ..... Arena
Thomas E. Coale Lumber Co. ..... Arena
F. A. Coleman Co. ..... Exhib. Hall
Combined Supply & Equipment Co., Inc. ..... Arena
Corn Products Refining Co. ..... Arena
Daily Metal Trade ..... Arena
Davenport Machine & Foundry Co. ..... Exhib. Hall
Dayton Pneumatic Tool Co. .. Exhib. Hall
Wm. Wemmler & Bros. .... Exhib. Hall
Detroit Electric Furnace Co. .. Exhib. Hall
Henry Disston & Sons, Inc. .. Corridor
Joseph Dixon Crucible Co. ..... Arena
Dock & Mill Co. ..... Arena
Doehler Die-Casting Co. ..... Arena
Electro Refractories Corp. ..... Stage
Electric Welding Machine Co. ..... Exhib. Hall
Elwell-Parker Electric Co. ..... Arena
Fanner Mfg. Co. ..... Arena
Federal Foundry Supply Co. ..... Arena
Federal Malleable Co. ..... Exhib. Hall
The Foundry ..... Arena
Foundry Equipment Co. ..... Arena
Gallmeyer & Livingston Co. ..... Arena
General Electric Co. ..... Arena
Gibb Instrument Co. .....
Globe Iron-Crush & Shot Co. ..... Arena
Great Western Mfg. Co. ..... Arena
Robert Gordon, Inc. ..... Corridor
Grimes Molding Machine Co. .. Exhib. Hall
Hanna Engineering Works ..... Arena
Hardinge Co. ..... Arena
R. G. Haskins Co. ..... Arena
Hauck Mfg. Co. ..... Arena
Hayward Co. ..... Exhib. Hall
Herman Pneumatic Machine Co. ..... Exhib. Hall
Hill & Griffith Co. ..... Arena
Hillside Fluor Spar Mines ..... Arena
Hoevel Mfg. Corp. ..... Exhib. Hall
Holcroft & Co. ..... Arena
Independent Pneumatic Tool Co. ..... Exhib. Hall
Industrial Press ..... Arena
Ingersoll-Rand Co. ..... Exhib. Hall
International Molding Machine Co. ..... Exhib. Hall
Interstate Sand Co. ..... Arena
Iron Age ..... Arena
Iron Trade Review ..... Arena
Johnston & Jennings Co. .. Exhib. Hall
Jones Sand Co. ..... Corridor
Charles C. Kawin Co. ..... Arena
Keller Mechanical Engineering Corp. ..... Exhib. Hall
Spencer Kellogg & Sons, Inc. .... Arena
Kindt-Collins Co. ..... Stage
Julius King Optical Co. ..... Arena
King Refractories Co., Inc. .... Stage
Knefler-Bates Mfg. Co. ..... Corridor
Lakewood Engineering Co. ..... Arena
H. M. Lane Co. ..... Corridor
Lava Crucible Co. of Pittsburgh .. Arena
Leeds & Northrup Co. ..... Arena
Lewis-Shepard Co. ..... Corridor
Link-Belt Co. ..... Arena
Louden Machinery Co. ..... Stage
David Lupton's Sons Co. ..... Arena
MacLean Publishing Co. ..... Arena
MacLeod Co. ..... Exhib. Hall
Malleable Iron Fttings Co. .. Exhib. Hall
Marschke Mfg. Co. ..... Corridor
C. E. McArthur ..... Arena
J. S. McCormick Co. ..... Arena
McLain's System, Inc. ..... Arena
Master Tool Co. ..... West Corridor
Medart Co. ..... Corridor
Menefee Foundry Co. ..... Arena
Mercury Mfg. Co. .....
Metal & Thermit Corp. ..... Arena
Metal Industry ..... Arena
Michigan Smelting & Refining Co. ..... Arena
Modern Pouring Device Co. .....
Monarch Engineering & Mfg. Co. .. Arena
National Engineering Co. .... Exhib. Hall
National Scale Corp. ..... Stage
New Haven Sand-Blast Co. .. Exhib. Hall
Wm. H. Nicholls Co., Inc. .... Exhib. Hall
Norma Company of America ..... Arena
Northern Blower Co. ..... Corridor
Northern Refractories Co. . West Corridor
Norton Co. ..... Arena
S. Obermayer Co. ..... Arena
Ohio Machine Tool Co. .....
George Oldham & Son Co. .. Exhib. Hall
Oliver Machinery Co. ..... Exhib. Hall
Osborn Mfg. Co. ..... Exhib. Hall
Oxweld Acetylene Co. ..... Exhib. Hall
Pangborn Corp. ..... Exhib. Hall
J. W Paxson Co. ..... Arena
Peerless Sand Co. ..... Arena
Peffer Oil Co., Inc. ..... Corridors
Penton Publishing Co. ..... Arena
Pickands, Brown & Co. ..... Arena
Pittsburgh Electric Furnace Corp. ..... Arena



ARENA FLOOR · CLEVELAND AUDITORIUM

Henry E. Pridmore, Inc. ..... Exhib. Hall
Porcelain Enamel & Mfg. Co. ..... Arena
Portage Silica Co. ..... Arena
Quigley Furnace Specialties Co. ... Arena
Racine Tool & Machine Co. ..... Arena
Richards-Wilcox Mfg. Co. ..... Arena
Robeson Process Co. ..... Arena
Rogers, Brown & Co. ..... Arena
P. H. & F. M. Roots Co. ..... Arena
Roto Pneumatic Co. ..... Exhib. Hall
Royer Foundry & Machine Co. ..... Exhib. Hall
Sabin Machine Co. ..... Corridor
Safety Equipment Service Co. ..... Arena
Safety First Shoe Co. ..... Corridor
Shepard Electric Crane & Hoist Co. ..... Exhib. Hall
Simonds Saw & Steel Co. ..... Arena
Skybryte Co. ..... Arena
W. W. Sly Mfg. Co. ..... Arena
Smith Facing & Supply Co. ..... Arena
Werner G. Smith Co. ..... Arena
Spencer Turbine Co. ..... Exhib. Hall
Springfield Aluminum Plate & Castings Co. ..... Stage
Springfield Facing Co. ..... Stage
Stamp Electric Hoist Co. ..... Stage
Standard Equipment Co. ..... Exhib. Hall
Standard Sand & Machine Co. ..... Exhib. Hall
Sterling Wheelbarrow Co. ..... Arena
Frederic B. Stevens, Inc. ..... Stage
Stoney Foundry Engineering & Equipment Co. ..... Exhib. Hall
N. A. Strand & Co. ..... Arena
Sullivan Machinery Co. ..... Exhib. Hall
Super Arc Welding Machine Co. ..... Exhib. Hall
Superior Sand Co. ..... Arena
Tabor Mfg. Co. ..... Exhib. Hall
Taylor Instrument Companies ..... Stage
R. J. Teetor Co. ..... Exhib. Hall
Thomas Special Flux Co. ... West Corridor
Warner R. Thompson Co. ..... Arena
Truscon Steel Co. ..... Exhib. Hall
Union Petroleum Co. .... West Corridor
United Compound Co. ..... Arena
United States Graphite Co. ..... Arena
United States Silica Co. ..... Arena
Vibrating Machinery Co. .... Exhib. Hall
Wadsworth Core Machine & Equipment Co. ..... Arena
H. L. Wadsworth ..... Exhib. Hall
Waldo, Egbert & McClain ..... Arena
J. D. Wallace & Co. ..... Arena
Westinghouse Electric & Mfg. Co. ..... Exhib. Hall
Westinghouse Traction Brake Co. ..... Exhib. Hall
White & Bro., Inc. ..... Arena
Whitehead Bros. Co. ..... Arena
Whiting Corp. ..... Exhib. Hall
E. J. Woodison Co. ..... Exhib. Hall
Wyoming Shovel Works ..... Corridor
Young Bros. ..... Exhib. Hall
Zanesville Sand Co. ..... Corridor

EXHIBITION HALL · CLEVELAND AUDITORIUM

(Continued from page 309)

W. F. Piper, George Furman, E. L. Mitchell, E. J. Byerlein, Frank Hamel, J. A. Patterson and Pete Stefan.

BERKSHIRE MFG. CO., Cleveland—Air squeezer molding machines including those of the pattern draw type and combination squeeze and stripping plate type will be shown by this company together with vibrators, aluminum snap flasks, flask fittings, etc. G. L. Cannon and W. D. Frazer will represent the company.

BETHLEHEM STEEL CO., Bethlehem, Pa.—Specimen bars of iron from mixtures containing the Bethlehem Co.'s chrome-nickel iron will be shown. Illustrated photographs of the mining and reducing operations showing views of the Cuban mines from which the ore is obtained and also a representative lot of illustrations of castings made from this iron will be featured. This company will be represented by D. A. Barkley, H. G. Walton, H. P. Kreulen, Robert McDonald and M. D. Salisbury.

S. BIRKENSTEIN & SONS, INC., Chicago.—This exhibit will consist of metals and castings.

BLACK DIAMOND SAW & MACHINE WORKS, Natick, Mass.—The company will exhibit a combined band saw filing and setting machine; a circular saw filing machine for wood and soft metal cutting saws; a brazing outfit for narrow band saws; and saws of various types. Walter B. Ambler will be in charge of the booth.

BLYSTONE MANUFACTURING CO., Cambridge Springs, Pa.—A core-sand mixer with screen and motor attached will be the feature of this exhibit. Howard M. Jay, C. L. Smith and Luther G. Conroe will represent this company.

BONNOT CO., Canton, O.—Literature describing this company's pulverizing core system as applied to the malleable iron industry will be distributed. The company also will show pictures of malleable foundries equipped with its apparatus. The firm will be represented by Homer L. Rank, L. E. Oldham, E. W. Steele and Stockton Harter.

BRADLEY WASHFOUNTAIN CO., Milwaukee.—This company will exhibit a washfountain of its particular design. L. Slessinger will be in charge of the booth.

BRASS WORLD PUBLISHING CO., New York

BRIDGEPORT SAFETY EMERY WHEEL CO., Bridgeport, Conn.—A number of grinders among which will be alternating current floor grinders, alternating current wet and dry grinders and alternating current bufting lathes will form this company's exhibit. In addition sectional wheels will be shown. A. H. Kean and I. L. Burritt will represent the company.

BRITISH ALUMINUM CO., LTD., New York.—This company's exhibit will consist of a line of photographs of some of the aluminum castings made by its customers and also samples showing the development of metallic aluminum from the ores. Arthur Seligman, the United States representative of the company, will be in charge of the booth and be assisted by Arthur Jelljnek.

BUCKEYE PRODUCTS CO., Cincinnati.—A complete line of oil and gas fired crucible and furnaces for melting nonferrous metals, together with air and electric sand riddling machines, core oils, core compounds, parting compounds, refractory cements and other specialties will form this company's exhibit. The firm will be represented by C. J. Goehringer, E. O. Stamm, E. C. Hearn, R. B. Ferguson, R. M. Gleason and C. P. Stamm.

CAMPBELL-HAUSFELD CO., Harrison, O.—This company's exhibit will consist of noncrucible tilting type melting furnaces, tilting type crucible furnaces, tilting type aluminum melting furnaces using cast-iron melting pot, and a stationary type crucible furnace. The exhibit will be in charge of E. B. Hausfeld and J. S. Armour.

CARBORUNDUM CO., Niagara Falls, N. Y.—The exhibit of this company will consist of carborundum abrasive products including grinding wheels, polishing grain, abrasive disks, and carborundum refractory materials including high temperature firebrick, refractory cements, muffles and furnace linings. W. W. Sanderson, O. C. Dobson, H. E. Kerwin, L. Pitt, John MacArthur, C. E. Hawke and E. W. Jones will represent the company.

CARTER BLOXONEND FLOORING CO., Cleveland.—This company will exhibit 3 panels of its flooring. L. L. Bucklew, A. E. Giese, and Ruben Stowell will be in attendance.

FRANK D. CHASE, INC., Chicago.—This company will exhibit photographs of foundry buildings and equipment which have been designed by it. Frank D. Chase and Fred Graf will be in charge of the exhibit.

CHICAGO CRUCIBLE CO., Chicago.—Crucibles and stopper heads will be the principal feature of this company's exhibit. It will be represented by A. F. Hottinger, J. P. Foraker, H. C. Sorenson, Leroy C. Taylor, J. G. Crowe and J. W. Mann.

CHICAGO PNEUMATIC TOOL CO., New York.—An air compressor; grinders of the portable, pneumatic and electric types; a combination air hoist; and sand, floor and bench types of rammers will be exhibited by this company which will be represented by A. C. Andersen, Ross Watson, C. W. Campbell, W. H. White and A. H. Collins.

CHISHOLM & MOORE MFG. CO., Cleveland.—This company will exhibit hoists and cranes. E. S. Ludlow will be in charge of the booth.

CLARK TRUCTRACTOR CO., Buchanan, Mich.—This company will exhibit tractors of the hand hoist end dump, automatic gravity end dump, and tractor types. L. J. Schneider, R. J. Burrows, J. W. Taylor, C. I. Ucker, F. E. Cooper and J. Putnam Ware will be in attendance at the booth.

CLEVELAND ARMATURE WORKS., Cleveland.—Grinders and buffing machines will be shown. G. E. Zeil will be in charge of the booth.

CLEVELAND BLOW PIPE & MFG. CO., Cleveland.—This company's exhibit will consist of a dust collecting system, hoods and sand blast cabinets. E. Coney and F. W. Roberts will be in attendance.

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, O.—The Cleveland electric tramrail division of this company will have in operation, on 75 feet of rail section, various types of hand and electric power carriers; also a transfer bridge crane having a 9-foot span with necessary interlocks and discharge points to demonstrate its use. Represented by C. C. Robbins, R. C. Garnett, E. T. Bennington, H. C. Webb, R. E. Nelles, A. F. Anjeskey, S. F. Joor, D. T. Laylin, J. T. Brady and F. E. Chilcott.

CLEVELAND FLUX CO., Cleveland.—Samples of fluxes and minerals will be exhibited by this company. Clifford B. Cornell, John C. Cornell, Loren E. Souers, Miss Uline and Miss Harris will represent the company.

CLEVELAND PNEUMATIC TOOL CO., Cleveland—Demonstrations will be made of various lines of foundry tools, one section being given over to the operation of sand rammers, chipping hammers and air grinders. A number of pneumatic foundry tools as well as a complete line of all sizes of air hose couplings and pressure seated air valves will be shown. The company will be represented by E. S. Cook, H. S. Covey, Claus Greve, L. W. Greve, A. Scott, and George H. Hall.

CLEVELAND STEEL TOOL CO., Cleveland.—This company will exhibit a complete line of punches, dies, chisel blanks, and rivet sets. The principal feature will be the chisel blanks used for chipping iron and steel castings, billets, etc. Represented by R. J. Venning.

CLEVELAND WIRE SPRING CO., Cleveland.—This company will exhibit steel barrels and boxes. C. C. Klingman will be in charge.

THOMAS E. COALE LUMBER CO., Philadelphia—Pattern pine, pattern mahogany and flask pine will be exhibited. Thomas E. Coale, and Samuel D. Pettit will be in attendance at the booth.

F. A. COLEMAN CO., Cleveland.—This company's exhibit will consist of brass melting furnaces, aluminum melting furnaces, two styles of core ovens, and core racks. Representatives will be F. A. Coleman, C. G. Johnson, F. C. Gensler, P. E. Hand, R. W. Bronson, L. O. Ambrose, L. J. Creelman, and S. A. Coleman.

COMBINED SUPPLY & EQUIPMENT CO., INC., Buffalo.—Chaplets of various types will be exhibited in this booth which will be in charge of S. LeViness Jr., and C. L. Jackson.

CORN PRODUCTS REFINING CO., New York.—This company will demonstrate the core binder which it manufactures, making the mixtures of sand and doing the baking in the booth. A line of samples showing the different kinds of cores made with its binder will also be shown. S. B. Krantz, F. G. Faller Jr., A. H. Kreischer, and H. B. Farris will be in charge of the booth.

DAILY METAL TRADE, Cleveland.—This booth will be fitted up as a rest room where all those in attendance at the convention are invited to make their headquarters. Represented by J. F. Froggett, A. J. Hammond, W. J. Nolle, F. B. Pfletcher, M. H. Stocking, John Henry, L. C. Pelott, S. H. Jasper, A. M. Pulaski, G. O. Hays, W. G. Young, E. S. Gregory and M. Reiner.

DAVENPORT MACHINE & FOUNDRY CO., Davenport, Iowa.—This company's exhibit will consist of a jolt rollover pattern draw machine, a jolt strip machine and a jolt strip and squeeze machine, all equipped with mounted patterns, flasks, etc. The following representatives will be in charge: Carl Falk, A. Magnuson, Charles Scherer, Fred Seeman, Arthur Ziebarth and Earl Byerlein.

DAYTON PNEUMATIC TOOL CO., Dayton, O.—Pneumatic riveting and chipping hammers, sand rammers and couplings may be seen at this booth. William Gleasner, A. W. Clausen, E. C. Thompson, and L. B. George will be in attendance at the booth.

WM. DEMMLER & BROS., Kewanee, Ill.—An air-operated core machine will be shown.

DETROIT ELECTRIC FURNACE CO., Detroit.—Samples of material manufactured in this company's electric furnace will be shown together with photographs and literature in regard to the furnace. A. E. Rhoads, H. M. St. John, E. T. Gushee and E. L. Crosby will be the company's representatives.

HENRY DISSTON & SONS, INC., Philadelphia—The exhibit will consist of circular metal cutting saws, hack saw blades and frames, and a large variety of files. Joseph Dorrington, David M. Jenkins, and L. L. Mather will represent the company.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.—This exhibit will contain graphite products.

DOCK & MILL CO., North Tonawanda, N. Y.—Many pieces of white pine pattern

lumber and a white pine sawed log 3 feet in diameter will be used by this company to demonstrate how pattern, flask and templet lumber can be purchased to the best advantage and what grades should be purchased for the different kinds of pattern work. The company will be represented by M. M. Smith, Thomas Donaldson, Elmer Semon, Henry Homeyer, John Klinger and Walter M. Nantke.

DOEHLER DIE-CASTING CO., Brooklyn, N. Y.—This company will show die castings of aluminum, zinc, tin and lead base alloys. It will also exhibit completely assembled devices on which die castings are incorporated. Representatives will be Charles Wilson, K. H. Siemens and W. J. MacNeill will represent the company.

THE FOUNDRY, Cleveland.—The booth will be fittted up as a rest room where all those in attendance at the convention are invited to make their headquarters. Represented by A. O. Backert, D. M. Avey, H. E. Diller, Pat Dwyer, Charles Vickers, J. F. Ahrens, A. M. Pulaski, A. L. Klingeman, L. C. Pelott, S. H. Jasper, G. B. Howarth and H. T. Roberts.

FOUNDRY EQUIPMENT CO., Cleveland. —This company will show photographs of installations of its core and mold drying ovens and furnaces. Representatives will be C. A. Barnett, H. W. Steindorf, S. D. Rickheating industrial establishments, using coke, coal, oil or gas as fuel. T. H. Monaghan and A. L. Weixel will be in attendance at the booth.

GRIMES MOLDING MACHINE CO., Detroit—A number of molding machines will be exhibited including a jar ram rollover machine, a hand ram rollover machine, and a multiple molding machine. A sand sifter also will be shown. George L. Grimes, Charles J. Skeffington and John A. Rathbone will be in attendance.

HANNA ENGINEERING WORKS, Chicago.—This exhibit will consist of an air jolt squeeze split pattern machine, a plain air squeeze machine of the low trunnion type, a

Pack, H. B. Griffin, H. J. Robbins, G. H. Haskell and Marc Stern.

ELECTRO REFRACTORIES CORP., Buffalo.

ELECTRIC WELDING MACHINE CO., Detroit.

ELWELL-PARKER ELECTRIC CO., Cleveland.—This company will exhibit a number of different types of battery trucks. These will include a self-contained malleable iron annealing oven charger, and a crane truck for yard work, consisting of a revolving crane with a 12-inch boom. Represented by R. C. Howell, C. B. Cook, E. Collins, D. N. Hanchette, and C. E. Cochran.

FANNER MFG. CO., Cleveland.—This company will exhibit a line of foundry chaplets, tumbling mill stars, and flask trimmings. It will be represented by J. R. Raible, W. C. Hopkins, F. W. Beck, and C. Nelson Smith.

FEDERAL FOUNDRY SUPPLY CO., Cleveland.—This company's booth will be fitted up to receive guests. C. A. Collins, T. H. Terry, E. Kaye, George A. Fuller, Barney Bernbaum, John Bayer, W. A. Gluntz, Ralph Ditty, and L. H. Heyl will be in attendance at the booth.

FEDERAL MALLEABLE CO., West Allis, Wis.—This company will have a working exhibit of its molding machines including its new type jolt squeezer stripper machine. O. L. Hollister, M. W. Gleissner, L. C. ard, G. W. Bohn, M. A. Beltaire Jr., and E. J. Byerlein.

GALLMEYER & LIVINGSTON CO., Grand Rapids, Mich.—The company will exhibit types of jointers, bench saws, band saws and saw benches. Represented by D. H. Shartle, J. DeKoning and B. C. Saunders.

GENERAL ELECTRIC CO., Schenectady, N. Y.—This company will exhibit semiautomatic arc welding equipment in operation and show a model of an electric furnace. It will be represented by H. J. Hunt, P. A. McTerney, C. T. McLoughlin, R. D. Reed, J. M. Hollister, I. B. Terry and K. Tsuda.

GIBB INSTRUMENT CO., Bay City, Mich.—This exhibit will consist of various types of pyrometers.

GLOBE IRON-CRUSH & SHOT CO., Mansfield, O.—Castings, forgings and heat treated parts cleaned by this company's material together with a line of samples of its abrasives will complete this exhibit. The booth will be in charge of L. A. Cline and E. O. Townsend.

GREAT WESTERN MFG. CO., Leavenworth, Kans.—Gyratory foundry sand riddles will be shown by this company. The booth will be in charge of P. L. Wilson.

ROBERT GORDON, INC., Chicago—This exhibit will include a quarter size working model of this company's hot blast heater for cylinder air hoist, an unbalanced vibrator, and an I-beam trolley equipped with roller bearings. The following representatives will be be present: A. F. Jensen, John C. Hanna, O. F. Weiss and John O. Clark.

HARDINGE CO., New York.—This company will exhibit small operating models of its conical mill together with installation photographs and descriptive layouts showing how the mill operates in grinding the various classes of material such as graphite and coal for foundry facings, slag, sweepings, foundry wastes, etc. Harlowe Hardinge will be in charge of the booth.

R. G. HASKINS CO., Chicago.—This company will have an exhibit of flexible shaft equipments and portable tools covering the requirements of the metal industry. A working model of a belt shifter will be exhibited. R. G. Haskins will be in charge of the booth.

HAUCK MFG. CO., Brooklyn, N. Y.—This company will exhibit its cupola lighters, mold dryers, ladle heaters and its new high and low-pressure furnace burners for core ovens, as well as its preheaters used in connection with welding, and its open-hearth burner with automatic reversing valves. Represented by Herbert Vogelsang, F. A. Thomas, and Jules Escheman.

HAYWARD CO., New York.—This company will exhibit its electrically operated

bucket, a take-up reel and smaller models inculding an air operated orange-peel bucket. Represented by C. S. Sargent, H. C. Ryder and H. M. Davison.

HERMAN PNEUMATIC MACHINE CO., Pittsburgh.—This company will exhibit a small working model of one of its large jar rollover and pattern drawing machine. It will be represented by Thomas Kaveny, A. G. Doyle, Richard Harris, R. F. Ringle, I. J. Oesterling, C. W. Miller, R. P. Morgan, Robert M. Porteous, C. S. McMath and W. W. Huges.

HILL & GRIFFITH CO., Cincinnati.—This company will maintain a rest room for its visiting customers. It will be represented by John Hill, William Oberhelman, M. Z. Fox, Bruce Hill, C. L. Gysin, John H. Lyle and W. J. Smith.

HILLSIDE FLUOR SPAR MINES, Chicago—This company will display various products of its fluor spar mines including an iron foundry flux composed of 1/3 fluor and 2/3 calcite. J. L. Hench will be in charge of the booth.

HOEVEL MFG. CORP., Jersey City, N. J.—This company's exhibit will consist of a revolving barrel sand blast and a rotary table sand blast machines. J. M. Betton, L. B. Passmore and M. Herbig will represent the firm.

HOLCROFT & CO., Detroit—This company will exhibit photographs, drawings and technical data pertaining to its furnaces and ovens. Represented by C. T. Holcroft, R. T. Cadwell, C. L. Joy, O. E. Erisman, H. M. Gregory.

INDEPENDENT PNEUMATIC TOOL CO., Chicago.—A complete line of pneumatic tools for foundry use including air drills, hammers, hoists, sand rammers, moisture separators and air grinders together with electric drills and grinders will be exhibited in this booth. A special feature will be the company's new chipper and its power-driven screw driver used in foundries for making patterns and repairing flasks. The exhibit will be in charge of A. Anderson, who will have associated with him H. G. Keller, F. H. Charbono, H. F. White, Fred J. Passino, S. W. Lanham and Van W. Robinson.

INDUSTRIAL PRESS, New York.

INGERSOLL-RAND CO., New York.—This company will exhibit pneumatic tool equipment for use in the foundry such as sand rammers, chipping hammers, drills, riveting hammers, grinders, etc. It will also show a two-stage compressor with short belt drive and electric motor. Those representing the company will be G. A. Gallinger, W. A. Armstrong, G. Williams, J. W. Anderson and L. H. Geyer.

INTERNATIONAL MOLDING MACHINE CO., Chicago.—This company will exhibit hand and power roll-over molding machines, combination jolt ramming roll-over draw machines, jarring machines and combination jolt strippers, squeezers and combination jolt squeezers and core making machines. It will be represented by Edward A. Pridmore, W. W. Miller, E. G. Borgnis, M. J. Monahan and Geo. R. Mitchell.

INTERSTATE SAND CO., Zanesville, O.—An exhibit of molding sands for iron and steel castings and for melting furnace bottoms will be made by this company. Represented by E. M. Ayers, James Trainer and R. G. Hay.

IRON AGE, New York.

IRON TRADE REVIEW, Cleveland.—This booth will be fitted up as a rest room where all those in attendance at the convention are invited to make their headquarters. Represented by C. J. Stark, E. L. Shaner, H. R. Simonds, E. F. Ross, A. J. Hain, J. W. Hill, F. A. Steinebach, W. M. Rooney, R. T. Mason, G. O. Hays, John Henry, Max Reiner, A. L. Klingeman, S. H. Jasper, and H. Linton.

JOHNSTON & JENNINGS CO., Cleveland.—A working exhibit of air squeezers, combination jolt squeeze, jolt squeeze pattern drawing machines, jolt stripping plate machines, jolt rollover pattern drawing machines and plain jarring machines will be maintained by this company, who will also exhibit vibrators and accessories. Represented by T. J. Calhoun, J. L. Battenfeld and R. W. Gramling.

JONES SAND CO., Columbus, O.—Molding sands for aluminum, brass, iron, and steel casting, together with fireclay, will be exhibited by this company. N. M. Jones will be in attendance at the booth.

CHARLES C. KAWIN CO., Chicago.—This booth will be maintained as a meeting place for the clients and prospective clients of the company. Represented by Charles C. Kawin, J. H. Hopp, J. Tissing, James Jordan, William H. Griner and W. J. Mulcahy.

KELLER MECHANICAL ENGINEERING CORP., Brooklyn, N. Y.—This company will show one of its latest model automatic die sinking machines, specially adapted to pattern and corebox work. This machine will be shown in operation. A flexible shaft bench grinder also will be exhibited. Represented by S. A. Keller, Jules Dierckx, John C. Shaw, Charles Bitter, Henry Schreiber and A. J. Benson.

SPENCER KELLOGG & SONS, INC., Buffalo.—This company will display various grades of core oil and cores made with its oil by prominent foundries. W. L. Goetz will be in charge of the booth assisted by J. N. Yaeger, E. G. Allen, J. B. Catherall, R. L. Girven and W. B. Leslie.

KINDT-COLLINS CO., Cleveland—This company will exhibit a complete line of pattern supplies. The booth will be in charge of E. F. Kindt and O. Heisterkamp.

JULIUS KING OPTICAL CO., New York. Head and eye protection devices, goggles, helmets, masks and scientific colored glasses for welding and cutting will be featured by this company. Julius King II and J. J. Duffy will be in charge of the booth.

KING REFRACTORIES CO., INC., Buffalo.

KNEFLER-BATES MFG. CO., Indianapolis.—A demonstration of core binder and facing flour will be given, with samples of cores produced by this material. George B. Hill, Hervey Bates III, George P. Delaney and Herbert J. Bever will represent the company.

LAKEWOOD ENGINEERING CO., Cleveland.—A storage battery tier-lift truck, a storage battery tractor, and heavy duty trailers especially designed for foundry work will be exhibited. D. E. Van Deusen and W. A. Meddick will be in attendance at the booth.

H. M. LANE CO., Detroit.—This company will maintain a booth where its friends can meet to discuss foundry problems. Represented by H. M. Lane and A. O. Thomas.

LAVA CRUCIBLE COMPANY OF PITTSBURGH, Pittsburgh.—This company will exhibit a line of crucibles and furnace cements. Paul L. Berkey, Furman South Jr., Daniel E. MacLean and A. J. Gloekler will be at the booth.

LEEDS & NORTHRUP CO., Philadelphia.—This company's exhibit will include a two-couple hot and cold zone temperature recorder, an optical pyrometer for determining temperatures in melting furnaces and a multiple point recorder. Henry Brewer, Oscar Brewer and E. B. Estabrook will have charge of the booth.

LEWIS-SHEPARD CO., Boston.—This company will exhibit jacklift elevating trucks, singlelift elevating trucks, a portable elevator or stacker, a self-loading warehouse truck for barrels and crates, and steel leg platforms for lift trucks. The company will be represented by H. B. Shepard and H. L. Brooks.

LINK-BELT CO., Chicago.—This company will display an electric hoist, rope pulley plain trolley type; a sand revivifier; a silent chain drive operated motor; also samples of the company's products along with some large photographs of actual working installations. S. L. Haines, and A. G. J. Rapp will be jointly in charge of the booth.

LOUDEN MACHINERY CO., Fairfield, Iowa—This company's exhibit will include everything in the monorail carrying system for foundry purposes for loads ranging up to a ton such as equipment for handling molten metal, carriers, push and pull traveling cranes, turn tables, as well as special containers for carrying the castings. Representatives in attendance will be H. M. Miller, L. F. Berthold, J. P. Lawrence, O. L. Smith, L. E. Gaston, William Buhl, W. H. Eldridge, W. Baylie, Elberg C. Wood and W. C. Seelbach.

DAVID LUPTON'S SONS CO., Philadelphia.—This company plans to exhibit samples of pivoted sash, continuous sash with operating device and counterbalanced sash together with enlarged drawings and photographs showing the principle of design of the Pond truss and frames and their adaptation to foundries. Clarke P. Pond will be in charge assisted by William Pfleider and George J. Wagner.

MACLEAN PUBLISHING CO., Toronto, Canada.

MACLEOD CO., Cincinnati.—This company will exhibit a sand blast tumbling barrell and table also sand blast cabinet and hose machine together with large photographs of installations it has made in foundries. James Lauder and James Shields will be in charge of the booth.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—Vibrators from 3/4 inch up to 5 inches, also a new air operated gyratory riddle and other foundry equipment will be shown by this company. The exhibit will be in charge of G. P. Pickop.

MARSCHKE MFG. CO., Indianapolis.—Electric motor driven grinders will be exhibited. The company will be represented by W. A. Marschke and F. W. Marschke.

C. E. McARTHUR, Chicago.—This exhibit will consist of pneumatic machines, including a pneumatic rod cutter and two combination pneumatic straightener and shear machines. Represented by C. E. McArthur, William M. Wilson and C. L. Stewart.

J. S. McCORMICK CO., Pittsburgh.—This company will exhibit a general line of foundry facings and supplies including its brands of blacking and binder. Represented by J. S. McCormick, T. E. Malone, S. R. Costley, C. C. Bumbaugh, and G. C. Smith.

McLAIN'S SYSTEM, INC., Milwaukee.—This exhibit will consist of samples of semi-steel castings of light section such as cylinders, pistons, piston rings, gears, etc. Annealed semisteel hatchets, hammers, pliers and automobile tools will be shown. Samples of the McLain's System lessons of cupola practice for gray iron and semisteel and steel foundry practice will be exhibited. Represented by David McLain and I. V. Scanlan.

MASTER TOOL CO., Cleveland.—Reclaimed pneumatic tools and their parts, such as riveting hammers, chipping hammers and sand rammers will comprise this exhibit. C. F. Overly will be in charge.

MEDART CO., St. Louis.—A cupola tapper and stopper manufactured by this com-

pany will be exhibited. A. G. Kaiser will be in charge of the booth.

MENEFEE FOUNDRY CO., Fort Wayne, Ind.—This company will exhibit a pattern compound and patterns made from it.

MERCURY MFG. CO., Chicago.—A battery truck will be shown by this company.

METAL & THERMIT CORP., New York.—This company will exhibit samples of thermit metals and alloys. Arthur F. Braid will be in charge of the exhibit.

METAL INDUSTRY, New York.

MICHIGAN SMELTING & REFINING CO., Detroit.—This exhibit will consist of ingot brass and bronze, and other nonferrous alloys together with rough and finished castings made from the company's ingots. Represented by R. R. Arnold, B. P. Cook, Henry Levitt, Harry Phillips, C. F. McRae, J. R. Searles, and Norman H. Sillman.

MODERN POURING DEVICE CO., Port Washington, Wis.—This company will show models of its pouring device.

MONARCH ENGINEERING & MFG. CO., Baltimore.—This company's exhibit will consist of the following: Combination core oven for all fuels, tilting crucible furnace, stationary crucible furnace, patented iron pot aluminum tilting furnace, soft metal melting furnace, double chamber brass furnace, tilting and stationary iron cupola of small capacity, together with several other types of furnaces, and a sand mixer. Represented by George C. Schimpf, Lees Hall, Frank Maujean, James V. Martin and H. D. Harvey.

NATIONAL ENGINEERING CO., Chicago.—A 6-foot diameter sand mixer will be maintained in actually mixing foundry sand and will be equipped with a high type bucket loader. The entire outfit will be operated through a direct motor drive. Represented by H. S. Simpson, J. T. Simpson, Barney Castor, S. H. Cleland and C. J. Skeffington.

NATIONAL SCALE CORP., Chicopee Falls, Mass.—This exhibit will include a display of counting and weighing machines, elevating trucks, multiple unit adjustable steel shelving and the calling system devised by this company. Represented by H. S. Trezevant, W. B. Paulson, J. S. Bierhardt, F. A. Moran and L. I. Howard.

NEW HAVEN SAND-BLAST CO., New Haven, Conn.—This company will exhibit sand blast equipment. It will be represented by Clarence Billings and George Fatscher.

WM. H. NICHOLS CO., INC., Brooklyn.—Eight or ten molding machines of various sizes, some of which will be in operation, will be exhibited by this company. William H. Nicholls, James F. Hines, E. J. Byerlein and H. P. Mackinnon will be in attendance at the booth.

NORMA COMPANY OF AMERICA, New York.—This company's exhibit will consist of precision ball bearings and ball thrust bearings, a precision measuring instrument and precision roller bearings of the self aligning and standard types. R. E. Hecker will be in charge.

NORTHERN BLOWER CO., Cleveland.—Metal core ovens with racks and core room equipment, sand blast rooms, a dust arrester, emery exhaust systems and pneumatic conveying installations will be exhibited at this booth. M. A. Eiben will be in charge assisted by L. L. Eiben, Charles Weger and C. H. Uthe.

NORTHERN REFRACTORIES CO., Ridgway, Pa.—The company will exhibit molding sands, fire clays and refractory mortars. J. Ellis Harvey will be in charge of the exhibit.

NORTON CO., Worcester, Mass.—This company's exhibit will consist of floor stands and bench stands suitable for foundry work together with a display of grinding wheels featuring the type of wheels used in foundry work. Represented by Albert R. Sandine, R. H. Cannon, A. T. Douglas and G. A. Parks.

S. OBERMAYER CO., Chicago.—A line of foundry supplies will be exhibited by this company. Represented by Theodore Kauffman, S. T. Johnston, E. D. Frohman, L. A. Gosiger, C. M. Barker, H. E. Beckman, F. P. Bullion, J. L. Cummings, W. R. Cummings, F. O. Eskew, J. E. Evans, L. M. Geer, F. Herberg, Frank Flynn, O. W. Josephson, William Lawson, J. J. McDevitt, O. C. Olson, O. J. Peterson, J. M. Remmes, W. C. Samuels and A. N. Wallin.

OHIO MACHINE TOOL CO., Kenton, O.

GEORGE OLDHAM & SON CO., Baltimore.—This company will exhibit foundry equipment such as chipping hammers, floor and bench rammers, and accessories. Represented by J. T. Biles, H. J. Bannister, R. W. Nelson, C. M. Hartzell, W. W. Davidson and C. E. Wortham.

OLIVER MACHINERY CO., Grand Rapids, Mich.—This company will exhibit a number of pattern makers' machines including band saws, jointers, surfacers, milling machines, lathes, grinders, wood trimmers, etc. Some of these are new models which have never been shown before. Represented by A. S. Kurkjian, Arthur Blake, G. C. Conklin, J. R. Duthie and J. E. McLauchlen.

OSBORN MFG. Co., Cleveland.—This company will operate a 5000-pound capacity direct draw rollover jolt molding machine with electrically operated rollover and pattern draw. A flask filling machine with a capacity of 1 cubic yard per minute, working in conjunction with 1000-pound capacity direct draw rollover jolt molding machine; several sizes of hand and jolt ram rollover machines, also stripping plate jolt and jolt squeezer machines will be shown. Represented by F. G. Smith, E. S. Carman, E. T. Doddridge, J. C. Alberts, F. T. Spikerman, R. E. Kiefer, M. R. Atwater, R. W. Hisey, E. F. Oyster, G. A. Sawitzke, D. Payne, J. D. Wise, O. Lowy and M. W. Zeman.

OXWELD ACETYLENE CO., Chicago.—Welding and cutting apparatus, acetylene generators, supplies, and demonstrations of welding and cutting may be seen at this booth.

PANGBORN CORP., Hagerstown, Md.—A complete line of sand blast equipment will be exhibited including room sand blast, hygienic cabinet sand blast, rotary tables and barrel sand blasts in various types and sizes. Samples of sand blasted castings will be shown with illustrations of installations of various types of equipment for different foundry products. Operators' protective clothing will be exhibited together with metal abrasives. Represented by Thomas W. Pangborn, John C. Pangborn, P. J. Potter, Foster J. Hull, H. D. Gates, George W. Cooley, Jesse J. Bowen, Roy C. Koch, Fred E. Wolf, Charles T. Bird and W. C. Lytle.

J. W. PAXSON CO., Philadelphia—This company will show sand blast equipment and foundry supplies. It will be represented by H. M. Bougher, I. F. Kremer, H. W. Titgen, J. F. Gaehring, H. F. Hoevel.

PEERLESS SAND CO., Conneaut, O.—This company will exhibit its complete line of molding and core sands. C. M. Bixler, F. L. Moore, C. J. Dowe and U. E. Kanavel will be in attendance at the booth.

PEFFER OIL CO., INC., Wilkes-Barre, Pa.—Sample cores together with samples of oil will be shown by this company. Edward McGleann will be in charge of the booth.

PENTON PUBLISHING CO., Cleveland.—This booth will be fitted up as a rest room where all those in attendance at the convention are invited to make their headquarters. Represented by John A. Penton A. O. Backert, R. E. Power, J. D. Pease and F. V. Cole.

PICKANDS, BROWN & CO., Chicago.—This company will exhibit samples of Solvay foundry coke made in its ovens at Chicago, Milwaukee and Detroit. J. A. T. Long and J. A. Ballard will be in charge of the booth.

PITTSBURGH ELECTRIC FURNACE CORP., Pittsburgh.—This company will show photographs of its furnace and will distribute bulletins and literature regarding the operation of its furnace. Representative castings made from electric furnace steel also will be included. Represented by C. L. Foster, O. J. Abell, M. A. Beltaire, Alexander Haigh, P. Hamilton, R. D. Thomas, W. B. Wallis, H. E. Bromer, J. R. Eckley and J. F Baker.

HENRY E. PRIDMORE, INC., Chicago.—A 12 x 12-inch power squeeze strip machine, a 16 x 20-inch, 8-inch draw, combination jolt and strip machine, and a 24 x 24-inch, 8-inch draw, combination jolt power rockover foot draw machine will be exhibited by this company. Represented by Mrs. Henry E. Pridmore, Henry A. Pridmore, Marshall E. Pridmore, Earl B. Pridmore, D. F. Eagan, Charles H. Ellis and Frank W. Hamel.

PORCELAIN ENAMEL & MFG. CO., Baltimore.—This company will fit up its booth as a rest room. It will be represented by Heinrich Turk, Karl Hurk, Frank G. Roberts and W. R. Greer.

PORTAGE SILICA CO., Youngstown, O.—This company's exhibit will consist of samples of conglomerate in its natural state, and of the company's various finished products, especially steel molding sand and sand blast sands. Photographs of the company's plant and operations also will be shown. E. E. Krooz will be in charge of the booth assisted by Messrs. Farrell and Eberhart.

QUIGLEY FURNACE SPECIALTIES CO., New York.—An electric furnace will be operated to demonstrate the binding qualities of the company's high temperature cement and the resistance of its refractories to sudden temperature changes. Samples of refractories, cement and insulation products will be shown. W. S. Quigley, W. H. Gaylord Jr., and W. A. Toohill will represent the company.

RACINE TOOL & MACHINE CO., Racine, Wis.—This company will exhibit a complete line of speed metal cutting machines and power action saws consisting of 4-inch, 6-inch and possibly 12-inch machines, also its high speed screw cutting machine. It will also exhibit a new design of portable band saw of the duplex type which is used for sprue cutting in brass and aluminum foundries.

RICHARDS-WILCOX MFG. CO., Aurora, Ill.—This exhibit will include overhead conveying tracks of both trolley and I-beam types, switches, crossovers, etc. Represented by W. H. Fitch, A. J. Eggleston, Ellis Phillips, E. A. Smith, B. Daugherty, H. R. Butler, Frank H. Wente, W. L. Wente, C. E. White, J. A. White and T. G. Perry.

ROBESON PROCESS CO., New York.—This company will exhibit samples of core binders. Represented by Gordon I. Lindsay, W. E. Baird, T. J. Ryan, T. J. O'Hara and B. W. Bullen.

ROGERS, BROWN & CO., Cincinnati.—A new metal mixture calculator will be shown and demonstrations will be made constantly. A handy working calculator will be distributed. Stenographic and telephone service will be provided and the company will take care of any mail or telegrams that may be addressed in its care. The following will be in attendance at the booth, J. C. Mears, A. B. Weaver, Harwood Wilson, C. P. Hell-

wig, L. M. Billingslea, R. T. Melville, A. F. Stengel, W. R. Maher, Thomas A. Wilson, C. D. Shepard, G. R. Sullivan, S. B. Morrison, J. C. Claussen, F. E. Fitts, H. W. Fernald, F. W. Bauer, A. J. Wentworth, F. I. Teal, L. W. Hoefinghoff and J. R. Morehead.

P. H. & F. M. ROOTS CO., Connersville, Ind.—A working model of a rotary blower, and a hand operated blower will be shown by this company. H. M. Papworth, D. R. Schnively, C. C. Abbott and J. B. Patterson will be in attendance at the booth.

ROTO PNEUMATIC CO., Cleveland.—This company will exhibit pneumatic grinders and electric drills, R. J. Emrich, E. J. Moore and W. Crooker will be in attendance.

ROYER FOUNDRY & MACHINE CO., Wilkes-Barre, Pa.—This company will exhibit a sand separator and blender. It will be represented by G. F. Royer, John Lloyd and W. M. Williams.

SABIN MACHINE CO., Cleveland.—This company's exhibit will consist of a one-man truck for handling open top steel shop barrels, and a line of steel barrels for foundry use. H. B. Sabin, O. C. Sabin and A. E. Dorod will be in attendance.

SAFETY EQUIPMENT SERVICE CO., Cleveland.—This company will display a complete line of safety equipment including safety goggles, sand blast helmets, respirators, safety clothing, gloves, foundry leggings, aprons, and safety and danger signs. H. L. Wood will be in charge of the booth.

SAFETY FIRST SHOE CO., Boston.—This company's exhibit will consist of samples of six different types of shoes designed for protection, comfort and service in the foundry. Edgar C. Davidson will be in charge of the exhibit.

SHEPARD ELECTRIC CRANE & HOIST CO., Montour Falls, N. Y.—This company will exhibit a 10-ton crane trolley and a 3-ton cage control monorail electric hoist such as is used in foundries for carrying ladles, handling flasks, transporting castings, etc. It will also show a floor control variable speed electric hoist and other hoists. A small car hauling winch and samples of gearing also will be exhibited. Represented by N. P. Farrar and H. A. Baugh, W. C. Minier and F. A. Hatch.

SIMONDS SAW & STEEL CO., Fitchburg, Mass.—This company will show a complete line of metal cutting circular saws, metal cutting band saws, hack saw blades and files. A fine-tooth inserted-tooth metal cutting saw will be demonstrated in operation in a cold cutting-off machine. H. B. McDonald, George R. Bird and George T. Curtis will represent the company.

SKYBRYTE CO., Cleveland.—This company will have a demonstration of cleaning dirty windows taken from various foundry buildings. It will be represented by J. N. Gordon, H. W. Whale and T. T. Holt.

W. W. SLY MFG. CO., Cleveland.—A working model will be maintained by this company to demonstrate the pneumatic method of elevation when used in connection with metallic abrasives. This model will incorporate the separation of the abrasives from dust and core sand as achieved by a dust arrester. Photographs of installations together with charts of various features of the company's equipment will be shown. Represented by S. C. Vessy, F. W. Klatt, F. A. Ebeling, D. L. Harris, G. A. Boesger, D. P. Carter, C. P. Guion, J. C. Wilkinson, M. T. Mortensen, and Messrs. Dougherty, Kammerer, Hasselle, and Kingsland.

SMITH FACING & SUPPLY CO., Cleveland—A display will be made of facings and compounds manufactured by this company. George W. Fleig, F. Ray Fleig and James S. Smith will be in attendance at the booth.

WERNER G. SMITH CO., Cleveland.—This company will exhibit samples of its various core oils together with specimen cores made from these oils. Werner G. Smith, Milton S. Finley, Frank H. Dodge, L. P. Robinson, John Glass, William E. Rayel, I. M. Gerteis and Louis F. Ferster will be in attendance at the booth.

SPENCER TURBINE CO., Hartford, Conn.

SPRINGFIELD ALUMINUM PLATE & CASTINGS CO., Springfield, O.—This company's exhibit will consist mostly of match plates but will contain some of the specialties manufactured by the company including a mold jacket. I. F. Hook and E. A. Parker will be in attendance at the booth.

SPRINGFIELD FACING CO., Springfield, Mass.—Plumbago wash, sea coal and core compounds will be shown in this company's exhibit. F. B. Atwood and T. F. Stokes will be in charge of the booth.

STAMP ELECTRIC HOIST CO., Cleveland.—This company will exhibit one of its standard electric hoists, and will be represented by C. E. Stamp, F. F. Seaman, R. E. Annis, W. T. West.

STANDARD EQUIPMENT CO., New Haven, Conn.—This company's exhibit will consist of one standard radial sand blast barrel with a number of parts disassembled. C. A. Dreisbach and C. S. Johnson will be in attendance at the booth.

STANDARD SAND AND MACHINE CO., Cleveland.—This company will exhibit core and facing sand mixtures, and pulverizers for breaking unused broken cores and other lump material. Represented by H. E. Boughton and P. E. Lacey.

STERLING WHEELBARROW CO., Milwaukee.—This company's exhibit will be comprised of its line of steel foundry flasks, wedges, shop boxes, wheelbarrows and trucks. I. R. Smith, H. H. Baker, J. M. Dickson, J. J. Coyne, R. J. Romain, O. E. Steep, H. J. Felsburg and G. H. Lambkin will be in attendance at the booth.

FREDERIC B. STEVENS, INC., Detroit.—This booth will be maintained for receiving and entertaining customers and friends. Samples of products of the company such as Ceylon plumbago, core compound, parting, tripoli composition, white nickel finish, etc., will be exhibited. Represented by Frederic B. Stevens, W. J. Cluff, J. M. Mayers, H. T. Taylor, Ward Dean, C. J. Menzemer, James F. Huges, J. M. Johnston, W. H. Dee, Daniel Campbell, C. R. Janson, E. R. Sutton, T. H. Ledden and C. L. Hall.

STONEY FOUNDRY ENGINEERING & EQUIPMENT CO., Cleveland.—This company will show at the booth only its patented shake-out bails and will arrange to bring foundrymen interested in its molding machines to the plant of the Ferro Machine & Foundry Co. to see the machines in actual operation. John T. Stoney, R. E. Stoney, E. S. Cohen, George Gage, Joseph Soukop and M. Oberacker will be in attendance at the booth.

N. A. STRAND & CO., Chicago.—This company will exhibit flexible shaft grinders. Represented by N. A. Strand, C. W. Blakeslee and George C. McKay.

SULLIVAN MACHINERY CO., Chicago.—As at every foundry show for the past 10 years compressed air for exhibitors' purposes will be supplied by this company using an angle compound air compressor. Other machines to be exhibited include straight line single stage belt driven compressor with a splash oiling system and wafer valves; a single drum portable compressed air hoist, a compressed air forge hammer, and compressed air core busters of two different types. The exhibit will be in charge of R. T. Stone.

SUPER ARC WELDING MACHINE CO., Detroit.—This company's exhibit will include a line of welding equipment. The booth will be in charge of J. P. Kryza, O. T. Bredeken and H. E. Bradford.

SUPERIOR SAND CO., Cleveland.—A full line of molding sands for the production of gray and malleable iron, brass and aluminum castings will be exhibited by this company. W. H. Smith, W. T. Findley and H. C. Koontz will be in charge of the booth.

TABOR MFG. CO., Philadelphia.—This company will exhibit a full line of its standard sizes of molding machines including squeezers, jar squeezers, plain jarring machines, shockless jarring machines, jar roll-over machines, jar strippers and hand ram rollover machines. Represented by Wilfred Lewis, H. W. Brown, J. T. Ramsden, J. H. Coleman, W. E. Sewell, H. W. Impey, E. S. Lewis, John Fendner, T. L. Summer and Philip Shire.

TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y.—This exhibit will include recording thermometers for core ovens, molten metal indicating pyrometers, and thermometers. The booth will be attended by G. A. Howell, H. W. Maurer Jr. and N. C. Schmid.

R. J. TEETOR CO., Cadillac, Mich.—This company will have in operation two of its molding machines. R. J. Teettor will be in charge of the exhibit.

THOMAS SPECIAL FLUX CO., Cleveland.—Samples of special fluxes will be shown by Charles M. Porris.

WARNER R. THOMPSON CO., Detroit.—This company will exhibit different grades of core sands. The booth will be attended by W. Edward Thompson, John E. Love, Miss F. J. Snyder, Warner R. Thompson.

TRUSCON STEEL COMPANY, Youngstown, O.—This company will show a complete line of 23 products for foundries among which the most prominent are alloy steel flasks, core plates, light constructed bottom boards, core racks, platforms, and boxes. It will be represented by G. J. Sparks, F. F. Griswold, G. E. Madden, G. E. Snedeker, J. A. Morrissey, J. C. Peirce, H. W. Jencks, N. C. Ferreri and P. A. Nuttall.

UNION PETROLEUM CO., Philadelphia.—Samples of oils and lubricants will be shown. T. D. Simpson will be in attendance.

UNITED COMPOUND CO., Buffalo.—This company will exhibit samples of vent wax, pattern wax and corrugated gaggers. Represented by John W. Bradley, William F. Bradley and Leslie F. Leney.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Mexican graphite plumbago foundry facings, core washes and motor and generator brushes will be exhibited by this company. Mexican graphite products such as greases and lubricating graphite will also be shown. Represented by H. F. Gump, R. J. Edmiston, C. D. McIntosh, G. D. Robinson and A. J. Heindel.

UNITED STATES SILICA CO., Chicago.—This company will exhibit samples of sand for blasting and for steel molding and core making; also samples of castings that have been sand blasted by its product. It will distribute printed matter regarding plant operation and results obtained by the use of its sands. Represented by Volney Foster, H. F. Goebig and Laudell B. Coats.

VIBRATING MACHINERY CO., Chicago.—This company will exhibit electric sand sifters. J. Schroeter will be in attendance.

WADSWORTH CORE MACHINE & EQUIPMENT CO., Akron, O.—This com-

pany's exhibit will include core making machines, a core cutting off and coning machine together with all steel reinforced core plates and bottom plates. Represented by George Wadsworth and M. C. Sammons.

H. L. WADSWORTH, Cleveland.

WALDO, EGBERT & McCLAIN, Buffalo.—This company's exhibit will consist of displays of pig iron of various grades and analyses, coke of different brands, galvanized sheets, coal, etc. Fred J. Waldo, Justus Egbert, William J. McClain, M. F. Selbert, Loring G. Calkins and K. E. Engstrom will be in attendance.

J. D. WALLACE & CO., Chicago.—This company will show a number of machines including a bench 6-inch jointer and a bench 4-inch planer, a bench plane saw, a bench universal saw, a bench 16-inch band saw, a bench glue pot. Represented by J. D. Wallace, H. L. Ramsay, H. C. Keller, F. W. Andresen, A. M. Andresen and J. B. Murphy.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa.—This company will exhibit a complete automatic substation in full operation, applicable to foundry use. Electric meter cores will be molded and baked in an electric oven. A 20-horsepower motor fitted with brake will be operated from the automatic substation. A 75-horsepower starting panel will be shown. Several samples of lighting fixtures for foundry use will be displayed. Represented by W. W. Reddie, C. D. Pence, J. H. Starr, F. D. Egan, W. L. Newmeyer and A. D. Turner.

WESTINGHOUSE TRACTION BRAKE Co., Pittsburgh.—This company will exhibit an air compressor to be driven by a 60-horsepower motor through herringbone gear and pinion, including automatic water control valve, all mounted on common bed plate. It will also show a main reservoir enameled inside and out, designed for a working pressure of 140 pounds per square inch. Several different types of air operating valves as well as a number of air cut-out cocks, etc., will also be exhibited. Represented by M. H. Burchard, S. A. King Jr., O. H. Miller, J. F. Ames, F. C. Young and E. H. Weaver.

WHITE & BRO., INC., Philadelphia—Nonferrous metals of various compositions as well as samples of casting copper, manganese bronze ingots and white metals will be exhibited by this company. Raymond Hunter, L. D. Kluver, G. H. Krider, H. F. Reinhardt, Clarence B. White and Frank Krug will be in attendance at the booth.

WHITEHEAD BROTHERS CO., Buffalo. This company will exhibit foundry sands, clays and gravels, foundry facing, core binders, and supplies. Represented by A. J. Miller, V. L. Whitehead Jr., C. E. Andrews, R. L. Cleland, F. B. Clark, R. L. Carpenter, J. H. Whitehead, H. B. Hanley, A. Y. Gregory, R. Hashagen, A. W. Jacus and T. Hogan.

WHITING CORP., Harvey, Ill.—This company will have on exhibit a sand cutting and screening machine, an air hoist, a solenoid brake with motor in operation, a tumbling barrel with motor in operation, a foot brake and a mechanical brake for cranes, helical worm geared crane ladles, photographs, drawings, etc. Represented by J. H. Whiting, R. H. Bourne, J. R. Bates, A. H. MacDougall, J. S. Townsend, R. E. Prussing, R. J. Thomas, D. Polderman, A. W. Gregg G. P. Fisher, W. A. Goebel and C. H. Erickson.

E. J. WOODISON CO., Detroit.—Core and molding machines, foundry supplies, and platers and polishers supplies will be exhibited.

WYOMING SHOVEL WORKS, Wyoming, Pa.—This company will exhibit a line of foundry shovels.

YOUNG BROS., Detroit.—This company will show a number of designs of core ovens.

ZANESVILLE SAND CO., Zanesville, O.—A full line of molding sands will be exhibited. Fred G. Flegal will be in attendance.

Pattern Finish Allowance

By J. A. Heard

The article by K. V. Wheeler in the Dec. 1 issue of THE FOUNDRY on "Steel Foundries Need Standard Patterns," should meet with the approval of not only the patternmakers but of every one connected with the steel casting industry. From the writer's experience covering a period of 15 years the item in connection with finish allowance always has been in dispute . The accompanying illustration will show what one steel foundry was required to furnish for machining allowance, also the extremely large head which had to be cut off. The casting was poured in the position shown through an opening which served for both gate and riser.

The minimum size fillet for a given cross section when it is desirable to core a hole that is to be bored and what finish should be allowed in cored holes are among the questions that arise every day and apparently every man is a law unto himself in this respect.

Cases are on record where the steel foundry has requested the pattern maker to furnish solid bosses, alleging as a reason that the casting would be free from porosity. However, this claim has not always proved correct. Other steel foundries insist on cored holes.

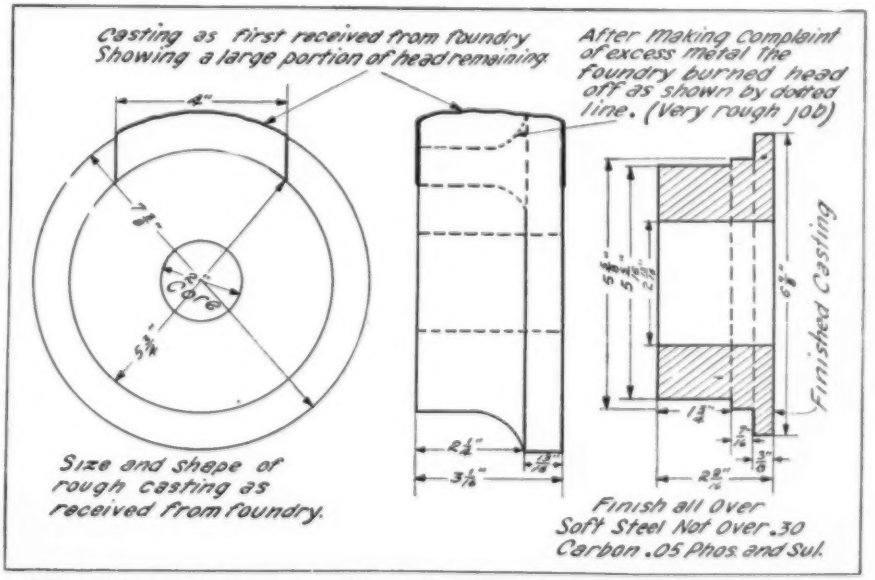
It is gratifying to note the publicity given Mr. Wheeler's paper on this important phase of foundry practice and it is to be hoped that the steel foundrymen in general will lend their assistance to standardizing patterns for steel foundries.

Green Sand Core Arbors

By Thomas Nelson

That nice sense of touch referred to by Pat Dwyer in a story on soil pipe manufacture that appeared in THE FOUNDRY, recently recalled to my mind methods practiced in a Scottish shop that specializes in somewhat similar pipes that serve as rain water conductors. The molds and cores are made in green sand, but instead of being swept on a barrel, the core is made in a two-part corebox. The arbors for the larger sizes are provided with wings, but in the smaller sizes, 4 inches and less, a single square bar is employed. No chaplets are used and the core iron extends approximately 18 inches beyond each end of the flask. The metal thickness in the casting is about 3/16-inch.

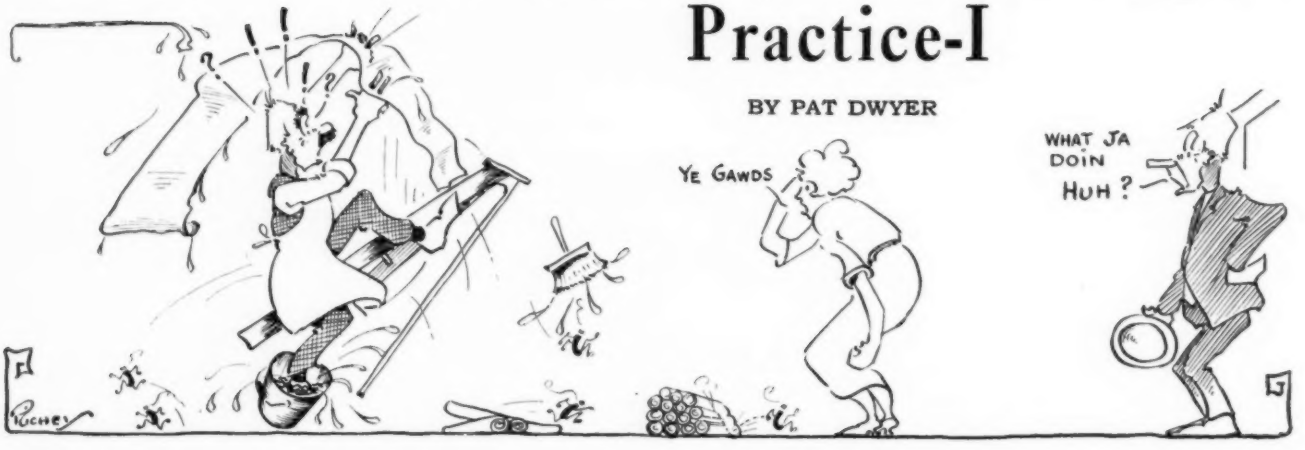
The core always sags to a certain extent when it is placed in the mold and on some occasions actually touches the drag face of the mold in the center. Before the first iron enters the mold, pressure is exerted on the ends of the arbor to raise the center of the core and permit the passage of the iron under it. To indicate the amount of pressure required, the molder makes a mark on the cope after the mold is closed. Thus, if the boy sees a cope marked I, he knows that a minimum pressure is required, while if the mark IV, he exerts a minimum. The marks II and III indicate a degree of pressure between the other two. The molds are poured through three flat gates directly on top of the mold. Three men with hand ladles do the pouring while a boy at each end attends to the core arbor, and experience enables them to exert the proper temperature


Casting as first received from foundry Showing a large portion of head remaining
After making complaint of excess metal the foundry burned head off as shown by dotted line. (Very rough job)
4"
7 3/8"
5 3/4"
Core
Size and shape of rough casting as received from foundry.
2 1/4"
3 1/2"
Finished Casting
Finish all Over
Soft Steel Not Over .30 Carbon .05 Phos. and Sul.

NOTE THE EXCESSIVE AMOUNT ALLOWED FOR FINISHING. ALSO THE EXTREMELY LARGE RISER WHICH HAS TO BE REMOVED WITH AN ACETYLENE TORCH

Bill Has a Word on Cupola Practice-I

BY PAT DWYER



BILL is one of these good natured lads willing and ready at any and all times to talk to any person on practically any subject. Perhaps I should qualify that statement a trifle after the manner of the man whose wife asked him what color wall paper he wanted on his den. The man said he did not care what color she selected so long as it was red. Bill is prepared to talk on any subject so long as it is about the foundry.

I have quoted the story of the red man because I have heard it so often that it sounds like an old friend. Privately, though, I always have entertained a discreet doubt on the subject. I never have seen any authentic statistics on this phase of married life and I never have felt sufficiently interested to attempt a collection and compilation of statistics on my own account. I only can quote from my own personal experience. No person ever has consulted me on my color taste.

On several occasions during a long and somewhat strenuous career I have been pressed into service at the time of the annual spring explosion when the house is turned upside down and inside out. I suppose first and last, in various places I have plastered a million square yards of wall paper; but I cannot remember a single instance where I was consulted before the wall paper was purchased. I am quite willing to admit that on each occasion, after the last yard of border had been coaxed into place around some particularly awkward corner, while the place still reeked with the offensive odor of stale paste, my attention graciously has been directed to the fact that the room looked swell. By the time we arrived at this stage I was in no condition mentally or physically to put up an effective argument even though I felt so inclined. Therefore, I always lined up with the majority and admitted that the color scheme was perfect.

In common with a vast army of down-trodden worms, occasionally in a burst of generosity, referred to as good providers, I have certain favorite colors, but I never lose any sleep because the bedroom wall paper presents garlands of impossible blue forget-me-nots on a cerise background. Similarly I never have noticed that my appetite was affected for better or worse irrespective of whether the dining room was finished in a poisonous green or a delicate shade of old rose. However, that is neither here nor there as the feller on the street car said after vainly searching all his pockets for the fare. What I had in mind was Bill's habit of oozing into a conversation and then gradually monopolizing the center of the stage the while he holds forth on his favorite subject.

He started in the other night by remarking casually: "Well, I believe everything is all set for the big show here in Cleveland the first of May."

I admitted that so far as I knew preparations were pretty well under way but I would not go so far as to say that everything was all set.

"The pit has been cleaned out," I said. "The cinder bed is down and the vent pipes have been placed to the best advantage. A gang of skilled men under the direction of Ralph West is busy leveling the sand bed and making some of the heavy cores. Mrs. W. C. Sly has engaged a full force of lady coremakers and according to present indications all the ornamental cores will be stoved and dried in ample time to go in the big mold. Foreman Charlie Hoyt is busy in Chicago supervising the construction of the pattern and he is quite confident he will have it here in time to go in the sand on the opening day of the convention. He expects to put approximately 4000 highly skilled foundrymen on the job in Cleveland and by working a few hours overtime every night he anticipates no trouble in getting the job out according to schedule."

"Grand work" said Bill, admiringly. "Grand work, me brave lad. With such a gang of high priced artists on the job we undoubtedly shall be treated to some wonderful exhibitions of ground and lofty foundry tumbling. I don't expect to take a prominent part in any of the activities, but have decided to kind of circulate around the edges of the job with a skimmer and touch off the vents occasionally.

"I count myself rather fortunate in that I enjoy the personal acquaintance of many of those who will be in attendance. With some the acquaintance is of comparatively recent standing and with others it dates back many years.

"Cleveland for many years has been recognized as one of the leading foundry centers of the United States and while a certain number of visitors now will see it for the first time, a large number will recognize it as the familiar scene of earlier foundry experiences. Probably a greater number of men have received part or all of their training in the foundries of Cleveland than in any other city in this country. Practically every size and type of casting in iron, steel, malleable and nonferrous metal is made here and foundrymen from practically all parts of the world have been impressed and derived inspiration from a view of the progressive equipment and the methods and processes in vogue.

"The late Thomas D. West spent the greater part of his adult life in Cleveland and his well known work on American foundry practice was

ONE OF THE 57 REASONS WHY WE SING "HOME, SWEET HOME"

based largely on his observations, investigations and experiments conducted in foundries in this city. Almost every traveling molder in the country at one time or another drew his card out of 218 and the name of the City Foundry, Kilby's, the Walker Works, later the Westinghouse, are familiar to men everywhere, accustomed to heavy work in green sand, dry sand and loam.

"The foundry business has had its ups and downs here as elsewhere. Days of peace and prosperity and days of strife, strikes and contention; but it has progressed steadily and may be regarded as a fair indication of the industrial lines on which Cleveland has expanded from a straggling lake port to a city of approximately one million population within the lifetime of some of the present inhabitants."

"What's the idea of all the enthusiasm?" I wanted to know. "To hear you talk one would imagine that your grandfather was one of the original band of sterling explorers who accompanied Moses Cleaveland on his trip from Connecticut to this wild land of the Western Reserve. One of those shrewd old Connecticut Yankees who exchanged a jug of red Demarara rum and a handful of wooden nutmegs for a tract of land as extensive as a New England farm."

"Well," said Bill "I'll tell you. I am not a native son and my grandfather did not come from Connecticut, but I am willing to bet four bits that if my grandfather had been fortunate enough to be in Connecticut at the time the General was organizing his expedition, he would have been one of the first lads to enlist in his service. As for the jug of rum, I have my doubts. Strictly between ourselves and taking into account that the Western Reserve at that time was almost 1000 miles and six months away from the base of supplies, I don't believe my grandfather would have traded a jug of rum for the entire territory.

"However, all that has nothing to do with the point at issue. I am willing to admit that if I had been born here I would be justified in feeling proud of the city; but on the other hand did you ever stop to consider that in coming here voluntarily and making my home I am justified in feeling a still greater interest? I never heard of any person being granted the privilege of selecting his place of birth.

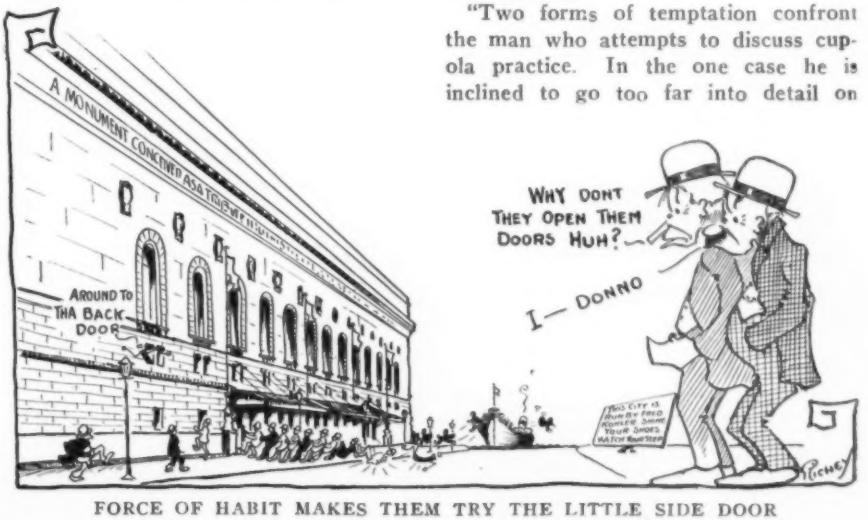
"Alright, let it go at that. I see you are getting ready to prove that I am talking high treason and all that kind of thing, that I am sapping the foundation of patriotism and insidiously trying to gnaw away the bulwarks of our present civilization. To all these and any other objections you may advance later I say—Pooh! Just like that. We are to a great extent governed by tradition and custom and comparatively few people ever do any independent thinking. If I had the time and if I thought you would listen I could cite a thousand instances to prove this contention. For example consider some of the curious features in connection with cupola practice in our American foundries.

"Probably every person at one time or another has noticed the importance of every feature in connection with any subject on which he has attempted any research work or on any subject with which he happens to have an unusually wide or intimate acquaintance. Conversely, we all are likely to underestimate the value of subjects with which we are not familiar. If we do admit that the subject may be worthy of attention in a general way, we are apt to minimize the importance of the details in connection with it. We conveniently forget that a multitude of trifles make perfection and perfection is no trifle.

"Fundamentally, melting iron in a cupola is a simple operation. Coke and iron are arranged in alternate layers until the cupola is filled to the charging door. The coke is ignited, a sufficient volume of air is admitted to promote rapid combustion. An intense heat is developed which melts the iron. The molten iron trickles through the fuel bed and after a sufficient quantity collects it is drawn off through the tap hole. As the iron is taken away at the bottom, additional iron and coke are charged at the top and the procedure is continued until a sufficient quantity has been melted to pour all the molds on the foundry floor.

"To the average layman, or one not familiar with foundry practice, nothing could be more simple and yet to the foundryman who has studied the subject to any extent, endless ramifications present themselves. He knows that unless the closest attention is paid to every detail and unless every factor connected with the operation is co-ordinated and synchronized, the cupola can produce more trouble in a foundry than any other element entering into the production of castings.

"Two forms of temptation confront the man who attempts to discuss cupola practice. In the one case he is inclined to go too far into detail on



FORCE OF HABIT MAKES THEM TRY THE LITTLE SIDE DOOR

actual operating conditions and cover ground that is familiar to foundrymen everywhere, even those with only an elementary knoweldge of the processes involved. In the other case he is apt to soar away into the rare atmosphere of pure science among the theories and underlying causes of complete combustion, chemical reactions, peculiar actions of gases as they ascend into the stack and the equally peculiar behavior of the various component elements of cast iron as it passes into the molten state and the subsequent rearrangement of the same elements as the iron once more assumes the solid state. So far as possible I shall try to avoid these two extremes and confine what few remarks I have to make to a few phases of cupola practice which in a great many foundries do not receive the attention which their importance warrants.

"In this connection it is interesting and gratifying to note the growth of foundrymen's associations. They not only promote a friendly feeling among those engaged in the industry in any given community, but they react on the industry as a whole. No one man knows it all and no one man possibly can work out the solution of all problems connected with the industry by himself. Meeting together at periodic intervals and exchanging views and experiences are bound to benefit each individual member. A chance expression, a word dropped at random may be the germ or seed of an idea falling on fertile ground that may lead to the solution of problems never dreamed of by the person making the remark.

"It is characteristic of human nature for each generation to think itself better than the ones that went before. This belief is justified to a certain extent, but foundrymen would do well to study some of the works of the old masters before they throw too many bouquets at themselves. In scientific control and mass production, probably we are away ahead of our ancestors, but in the matter of individual skill and in the production of either intricate or massive castings, the ancients established records that never have been surpassed.

"A considerable amount of research work has been carried on in recent years in connection with the problems involved in melting iron. The results of this work have been disseminated widely through personal contact, through correspondence and through the columns of the technical press. It has been established that a definite proportion of coke, iron and air are required to insure the efficient operation of a cupola and the production of castings that will conform to certain standards. Foundrymen generally are aware of these rules and if not they may familiarize themselves with them at a minimum expenditure of trouble and effort and yet we find that an astonishingly large number of cupolas are operated in a rather hit and miss manner.

"A few years ago at a time when foundries were turning down orders and when a combined steel, coal and railroad strike was threatening to cut off coke production, THE FOUNDRY sent out a questionnaire to several hundred foundries asking them to indicate their daily coke consumption and to outline their cupola practice in a general way. The questionnaire covered such items as cupola diameter; size and number of tuyeres; blast pressure; total daily melt; relative weight of coke and iron charges; class of castings produced; height of coke bed above the tuyeres; duration of heat and rate of melting per hour. Later these statistics were compiled analyzed and published in THE FOUNDRY, Sept. 1, 1920.

"If there was one feature more than another disclosed by that investigation, it was the utter lack of uniformity prevailing in the melting methods pursued by the foundries in this country. The tonnage involved varied from one or two tons in the case of little one-man shops casting two or three times a week to the big pipe and wheel shops in which several hundred tons of iron are melted daily. Even in the case of several shops operating on the same class of castings under exactly similar conditions, pouring the same amount of iron from cupolas of the same inside diameter, the dis-similarity in the reports were, in some instances, positively startling. The coke ratio varied from 1 to 4 up to 1 to 12 and while undoubtedly some of the figures were, let us say, slightly exaggerated, due to a common human failing which induces us to state what we should like to do rather what we actually have accomplished, the net result of the published statement indicates that an immense amount of coke is wasted annually in the casting industry."

"You probably are justified in the statement that coke is wasted in the foundry," I said "but it seems to me that a lot of talk also is wasted. Why don't you go ahead and show how this waste can be stopped instead of sitting there using words, words, words that don't get you anywhere?"

"There you go again," said Bill. "You are like many foundrymen. You are so sure that your own method is right that you won't even listen when any person attempts to show you the light. If your time is so precious that you can't listen while I unfold properly what I have in mind in connection with this subject, I shall say no more about it now, but I shall divide it into sections and feed you a small portion at a time on several occasions in the future. I have collected a good bit of dope on this subject and I certainly don't intend to keep it to myself."

The Gibb Instrument Co., of Bay City, Mich., manufacturers of electric welding equipment, have opened a sales office in Cleveland, at 2104 East Superior avenue. This office is in charge of W. O. Little.

MEMBERS OF THE PUT-AND-TAKE TEAM PRACTICE THEIR WELL KNOWN LITTLE SKETCH

SAFETY CODE FOR FOUNDRY WORKERS

(*Continued from Data Sheet No. 472*)

posts, partitions or other obstructions on one side of the aisle and similar objects on the other side.

Rule 131. *Condition*—Every aisle in which molten metal is being handled shall, during the progress of pouring, be kept in good condition, clear of obstructions and free from undue dampness.

Rule 132. *For Hand or Bull Ladles or Crucibles*—Aisles where molten metal is carried in hand or bull ladles or crucibles and poured into molds on individual floors by not more than two men per ladle or crucible shall not be less than 12 inches wide except where molds along side the aisle are more than 20 inches high above the aisle level, in which case the aisle shall be not less than 24 inches wide.

Rule 133. *For Hand or Bull Ladles or Crucibles*—Aisles where molten metal is carried in hand or bull ladles or crucibles and poured into molds on individual floors by more than two men per ladle or crucible shall be not less than 36 inches wide.

Rule 134. *For Crane, Trolley or Sulky Ladles*—Aisles where molten metal is carried and poured into molds on individual floors by crane, trolley or sulky ladles shall be sufficiently wide to safely handle and empty the ladles.

PART II—MACHINES AND EQUIPMENT

Section 20. EQUIPMENT

Rule 200. *Slag Spouts*—For protection against the spattering of slag, slag spouts should, where practical, be equipped with suitable shields.

Rule 201. *Lip-Pouring Ladles*—All lip-pouring ladles of 1000 pounds capacity or more shall be equipped with a worm gear or other self-locking device.

Rule 202. *Crane, Truck and Trolley Ladles*—All crane, truck and trolley pouring ladles shall be equipped with a dog to prevent premature overturning and shall be so constructed that when they are full of metal the center of gravity shall be below the center of the trunnion, unless each ladle is equipped with a gear mechanism and a latch, either of which will prevent premature overturning of the ladle.

(*Continued on Data Sheet No. 474*)

SAFETY CODE FOR FOUNDRY WORKERS

(*Continued from Data Sheet No. 473*)

Rule 203. *Single Shank Ladles*—All single shank ladles should be provided with sheet metal shields.

Rule 204. *Crown Plate of Furnace*—Where the crown plate of an upright crucible furnace is elevated above the surrounding floor in excess of 12 inches, the furnace shall be equipped with a platform having a standard rail; such platform shall be constructed of metal or other fire-proof material, and shall extend along the front and sides of the furnace, flush with the crown plate, and shall be clear of all obstructions. If the platform is elevated above the floor in excess of 12 inches the lowering from same of crucibles containing molten metal shall be by mechanical means.

Rule 205. *Sand Buckets*—Equipment for the movement of materials by overhead cranes, such as sand buckets, shall have a factor of safety of at least five, including bolts where used. When buckets have movable bails, safety locks or catches shall be provided, and the use of such safety locks or catches shall be enforced. Substantial steel handles shall be provided on grab buckets to afford safe means of pulling or prying apart the jaws in case cylinders stick.

Rule 206. *Sling Beams*—Sling beams shall be so constructed that the slings can not be jarred off the beam, and so that the slings can be readily moved to accommodate different size flasks.

Rule 207. *Trunnions on Flasks*—Trunnions on flasks hereafter constructed shall be carefully designed for the loads they are to handle and constructed with a factor of safety of at least ten including bolts where they are used. The diameter of the button shall be equal to the diameter of the groove plus one and one-half times the diameter of the sling used to handle the flask. Inside corners shall be well filleted and in order to prevent the sling sliding off or riding the button, the radius of the corner between groove and button shall be approximately equal to the radius of the sling used, the remainder of the inside edge of the button to be straight.

(*Continued on Data Sheet No. 475*)

THE FOUNDRY DATA SHEET, APRIL 15, 1923
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Controlling Cast Iron Hardness

Metallographic Study Showing the Different Constituents Indicates Causes of Hardness—Control Methods Outlined—Close Grained Iron Not Apt To Be Porous but Has Large Internal Shrinkage

BY S. J. FELTON

A LOW-CARBON steel which is made up of ferrite and pearlite is naturally comparatively soft, as indicated by the following table:

	Scleroscope	Brinell
Ferrite	17	100
Pearlite	30	200
Sorbite	45	275
Troostite	70	400
Austenite	90	550
Martensite	100	600
Cementite	120	800

A steel of about 85 per cent carbon is composed of pearlite and has a scleroscopic hardness of 30. A high-carbon steel contains pearlite and cementite (iron carbide) and is hard. When the temperature of steel is raised to above about 1300 degrees Fahr. the pearlite changes to austenite, and upon quenching, any one, or group, of the decomposition products, martensite, troostite and sorbite may be arrested and retained in the structure, thus materially affecting the hardness. Although there is some objection to the statement, cast irons may be considered as having the same structure as steels, with the exception that the continuity of the structure is broken up by flakes of graphite, which is exceedingly soft For instance, neglecting other elements, a cast iron containing less than about 0.89 per cent combined carbon is made up of ferrite, pearlite and graphite, and is called hypoeutectoid cast iron. A cast iron of about 0.89 per cent combined carbon is composed of the eutectoid, pearlite. The structure of gray cast iron containing over 0.89 per cent combined carbon consists of pearlite, cementite and graphite, and is called hypereutectoid cast iron.

As in the case of steels, the austenite of cast iron or its decomposition products may be retained, owing to sudden cooling, and the structure and hardness of the iron may compare with those of tool steels. The hardening effect of quenching cast iron is twofold, for not only are the hard decomposition products retained, but graphitization of cementite is arrested, so that less graphite and more cementite, which is the hardest material of the series, is formed. The two extremes of cast iron are malleable cast iron, composed of ferrite and free or temper carbon, and chilled white iron, composed possibly of martensite with a large amount of cementite. The large percentage of cementite in hypereutectoid cast iron, as compared with the amount of cementite in high carbon steel, gives the former material the possibility of being harder than the steel

The writer has seen malleable iron poured under the same conditions into two molds, side by side, one yielding a pure white fracture, and the other being heavily mottled. The only explanation of this phenomenon seems to be that the sand was damper, or rammed harder in the former mold, thus causing quick enough cooling to prevent formation of graphite nuclei. In the latter mold, the cooling was slow enough to allow graphite nuclei to form, and once formed, the precipitation of more graphite upon these nuclei was facilitated. The writer also has seen a floor of gray-iron castings which averaged 35.5 scleroscopic hardness, with the exception of several shaken out hot and accidentally sprayed with the hose in wetting down the sand, which ran 65.3 scleroscopic hardness. Castings shaken out at 1300 degrees Fahr. or above, and air cooled, are harder than those allowed to cool below a red heat in the sand. These examples illustrate the effect of quenching, or quick cooling, on the hardness of cast iron. It is probable that melting practice, pouring temperatures, and sand condition have a greater effect on the hardness than shaking-out temperatures, because the former act on the metal at that critical point of solidification, when the graphite nuclei first start to form.

The effect of the other elements of cast iron upon the combined carbon and the hardness thus produced are well known, but in most instances in which castings are reported hard to machine, the analysis of the iron fails to show why the castings should be hard. The previously mentioned variables affecting hardness in the foundry, such as melting practice, pouring temperatures, sand condition and shaking-out temperature, mask the effect of the metalloids. The writer's experience on castings made in green sand indicate that, with the other elements remaining approximately constant, a casting with 2 per cent silicon might be too soft and pourous, while the same casting with 2.3 per cent silicon might be too hard to machine satisfactorily, due to the effect of these variables. In other words, the hardening effect of quick cooling, caused by foundry variables, is more than sufficient to counteract the effect of 0.30 per cent silicon.

Occasionaly the analysis of a casting will show low silicon, and the chemist may be at a loss to explain the off analysis, as his heats may

Metallographic Terms Defined

NOT MANY years ago, when control of mixtures by composition was gradually introduced, foundrymen were confronted with terms of elements with which they were not familiar, but with which they have since become well acquainted. Now the introduction of metallography has brought with it new terms, but these quickly will be mastered by all foundrymen interested in the theory of the structure of iron and steel. To elucidate terms in the accompanying article the following metallographical definitions are presented. Ferrite is applied to pure iron, while cementite is the carbide of iron, or iron united chemically with carbon. In this form the carbon is known as combined carbon. Pearlite is the eutectoid, or combination of ferrite and cementite. When pure it contains approximately 0.89 per cent carbon. Therefore, a steel or cast iron with more than this amount of combined carbon is made up of pearlite and cementite, while one with less than 0.89 per cent combined carbon is composed of pearlite and ferrite. Austenite is the solid solution of iron carbide in iron stable only at high temperatures, and martensite, troostite and sorbite are transition forms between austenite on the one hand and ferrite, cementite and pearlite on the other.

have been showing a uniform analysis. The ordinary method of sampling cast iron is to take about three samples throughout the heat and analyze collectively. It is a good practice to check up on portions of the heat frequently, by analyzing these samples separately, as this method will indicate to what extent the composition of the heat varies. In practically every instance where the cupola blast is controlled by pressure gage, the first few taps will be low in silicon owing to oxidation at the start of the heat. As the blast volume is excessive at the start and varies widely from day to day, it is impossible to put in a bed of the right height. Unless the blast is cut at the end of the heat when charging ceases, oxidation will also take place.

It must be realized that just a few hard castings in a big lot will cause considerable trouble in the machine shop. A machinist may be working on a lot of 1000 small castings which require no grinding of the tool under ordinary conditions. If there are 10 hard castings, he may have to grind the tool 10 times and will characterize the whole lot as hard. In the average practice of casting different grades of metal in the same foundry, the wrong metal sometimes is poured into molds. However, the fault does not always lie in the foundry, and it is a good plan to check up on all castings reported hard in the machine shop, as in some instances the tools may not be of the proper hardness. The writer recalls one instance in which some malleable iron castings dulled the tool and apparently exhibited the machining characteristics of hard iron. They were reannealed without notification to the chemist, and after reannealing machining difficulty still was experienced. The chemist was called and found the casting ductile. Under the microscope they showed a practically pure ferrite structure, the graphite, which aids in machining, having been oxidized in annealing. In this instance no benefit was derived from the reanneal.

There is a tendency among foundrymen to use hard, close-grained iron, in many instances where it is not necessary. It is sometimes stated that if castings are made to withstand pressure, the water or steam will leak through the grains of the metal if it is not close grained. The writer has had considerable experience with pressure castings, and never yet has seen a leak except through a defective area. It is true that the softer the mixture the greater the tendency for segregation and spongy spots, but on the other hand, with hard mixtures, internal shrinkage increases. Resistance to deflection, not strength, is the fundamental requirement of many machine tool parts, such as lathe beds, etc. If the casting can be handled, assembled, and sent to its destination without breakage, it will never break in service. Yet many firms make such castings from hard iron which causes difficulty in the machine shop. As far as our present knowledge of the relative deflection under small loads of strong and weak irons is concerned, the soft, weak iron will be entirely satisfactory in castings of this type. If hard bearing surfaces are required they are simple to obtain by means of chills. Of course, in punch-press frames and castings of that type, strength is desirable. However, our characterizations of irons as strong or weak are based almost entirely upon static tests, and there is some question as to just how these irons react to shock and alternating impact, such as are met under working conditions.

It can be readily seen from the structure of cast iron, that castings that are impractical to machine easily can be made. It is possible that the castings might be as hard as the tools or harder. This is particularly true where high-speed steel is used, for high-speed steel is not as hard as high-carbon steel. It must be admitted that in some cases the scleroscope and brinell readings are not representative of the machineability of the metal. However, the writer's experience indicates that in average practice a casting gives difficulty in machining when over 260 brinell or 43 scleroscope hardness. It should be understood that machineability is influenced by the type of machine, depth of cut, speed, etc.

There are various methods of obtaining hardness, but difficulty is generally encountered in making the different results check, particularly in cast iron. For instance, a hypereutectoid cast iron with high mineral and scleroscopic hardness may have the matrix so broken up by coarse graphite flakes, blow holes, or nonmetallic inclusions that its resistance to deformation is low, thus causing a large indentation when tested by the brinell method. The cementitic skin of cast iron which defies ordinary hardness tests must be taken into consideration, especially on light cuts.

In the case of malleable iron and steel castings, the annealing process, if properly carried out, removes to a great extent the hardening effect of the foundry variables. However, the annealing of gray iron cannot be as successfully accomplished because the low temperatures necessary, only partially remove the hardness. It is possible to control analysis, melting conditions and pouring temperature to quite an extent, so that it is entirely possible for a foundry to produce fairly uniform castings. As a matter of fact, in time it may be that machine shops will purchase castings on a hardness specification the same as a power station specifies B.t.u. and ash in coal.

Book Review

Tested Methods of Non-Ferrous Metallurgical Analysis, by Seymour Pile, M. A. and Reginald Johnston, cloth, 127 pages, 5 x 7¼ inches, published by H. F. and G. Witherby, London, England, and furnished by THE FOUNDRY, Cleveland for $3 net.

One of the most difficult problems in outlining methods for the analysis of nonferrous alloys is to put the methods in such an order that the analyst can find the proper one to fit the particular alloy which he is investigating. The authors have provided for this by treating each element separately instead of putting the alloy as the basis for the method. Thus instead of outlining a method for the analysis of tin-base bearing metals under that head, methods are given under the name of each element. A method for the determination of tin applicable under certain conditions is outlined under procedure *A*, while the method of procedure for the determination of tin in other alloys is given under *B*, etc., until a number of methods are put forth covering all characters of alloys in which tin would be found. The same routine is followed for the other elements. Thus the analytical chemist easily finds the correct method to use. The authors have endeavored to give the methods as clearly as possible and notes are added wherever these were thought to be beneficial in enabling the student to follow the method more closely.

To Rebuild Facing Mill

Bloomsbury Graphite Co., Bloomsbury, N. J., through Thomas C. Wolverton, treasurer, has advised it will rebuild its mill devoted to the manufacture of pipe blacking and mineral facing, which was damaged by fire recently. The new mill will contain three of the latest model mills for grinding foundry facings, increasing the company's capacity fully 50 per cent.

F. E. Holcomb has been elected president and general manager of the Williams Foundry & Machine Co., Akron, O. Other officers are: Vice president, S. F. Ziliox; secretary, E. C. Jackson; treasurer, G. C. Dietz; and assistant treasurer, W. O. Zehm.

Operating Wilson Foundry-III

Benefits of Metallurgical Control of Sand and Other Materials as Well as of the Melting Operations Shown by Charts—Sand Tested for Porosity —Conveyor Carries Castings to Cleaning Department

BY D. R. WILSON

BEFORE taking up the shake out and cleaning work it may be of interest to say something of the metallurgical division. The laboratory always has had control of much more than the metal, and by close collaboration between the foundry superintendent, the head of the laboratory, the head man in charge of the rigging, and one or two others, who act as a general committee, they have been able to correlate all of the work, which results in more economical production, and much more harmonious operation of the plant.

The fact that good iron of itself could not produce good castings always has been recognized by the company, and hence the laboratory has charge of sand, iron, and all other raw materials.

The entering tracks are so laid out as to bring the iron in above the general foundry floor level. The scales, furnished by the Howe Scale Co., Rutland, Vt., are of the suspension type, with all levers and knife edges protected by a small hood or housing overhead, while the weighing platform itself is suspended on four pendant rods.

Two cupolas have 72-inch and 84-inch diameter shells, and these have been lined to 36-inch and 66-inch respectively. They are used for the special mixtures, and the iron for these mixtures is piled in a nearby section of the yard. Thin steel scrap, most of which is tumbled, is used as medicine in the ladles, as is described later. Short steel rails cut to 1-foot lengths are used for economical melting in the small cupolas. As the charging cars proceed across the various scales the different ingredients are added.

The same general charging scheme is carried out in connection with the large 96-inch shell cupolas. The same type scales are used, and the same general arrangement of charging, except that the steel rail scrap is cut to 30-inch lengths instead of 1-foot lengths.

All return sprue and scrap from the foundry is put on the charging cars by the night gang and is divided as nearly even as possible among the cars, and these units constitute the first of the scrap addition. The cars then proceed across the various scales and obtain the different ingredients necessary for the completed charge. Dump carts are used for handling sand about the plant, for handling castings through the gangway to the cleaning room and for many other purposes.

Under ordinary circumstances all metal charges are weighed up complete in the yard, and pass to the charging platform ready for the cupolas. These cupolas were all equipped with regular charging machines when they were put in, but it soon was decided that these did not give an accurate enough mixture. Then the Wilson foundry carried on a long series of experiments trying to develop a satisfactory method of mechanical charging, but finally these were all abandoned in favor of hand charging under the direction of a representative of the laboratory. The weighed charges of coke are dumped on the floor in front of the cupola and forked in by laborers. After this is carefully distributed a weighed amount of limestone is added, and then the charging car containing the metal is brought up and carefully distributed.

Fig. 5 shows a general view of the entire charging floor with a battery of three cupolas in the foreground. This floor is of steel plate construction of 1000-pound per square foot capacity. Attention is called to the blast pipes over-

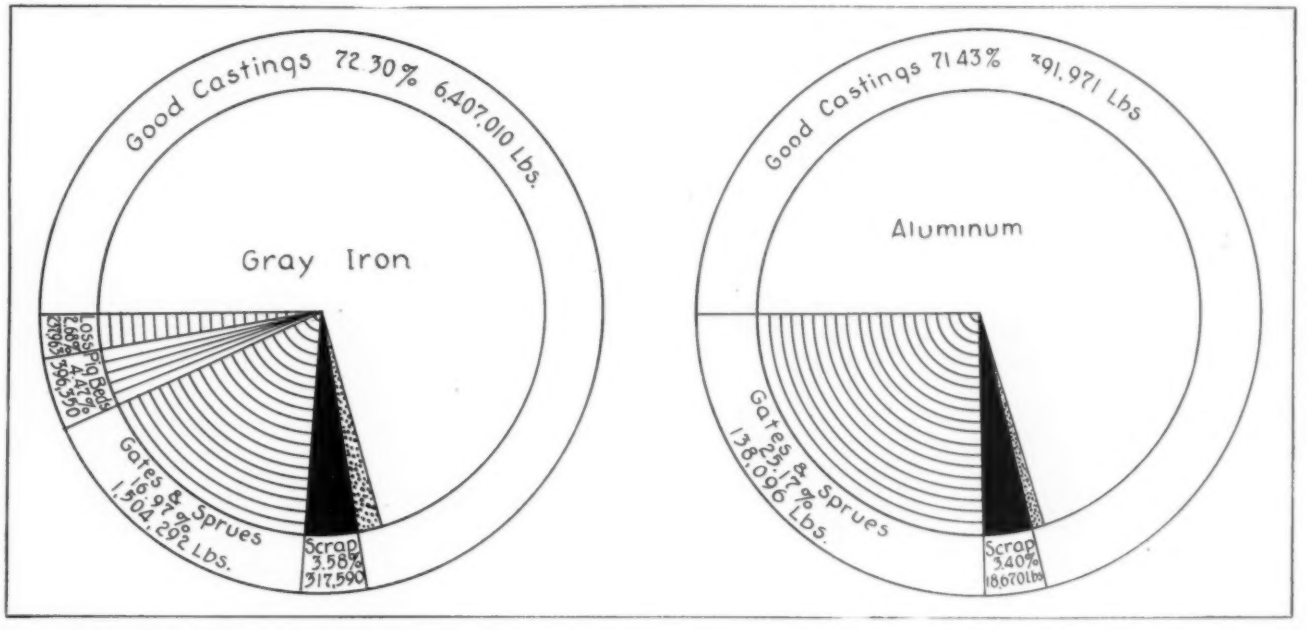


FIG. 1—RESULTS OF MELT IN GRAY-IRON SHOP FOR SEPT., 1920—DOTTED SEGMENT REPRESENTS FOUNDRY SCRAP IN THE MACHINE SHOP, EQUAL TO 1.57 PER CENT OF TOTAL MELT FIG. 2—SIMILAR CHART FOR THE ALUMINUM FOUNDRY—MACHINE SHOP SCRAP EQUALS 0.84 PER CENT OF TOTAL MELT

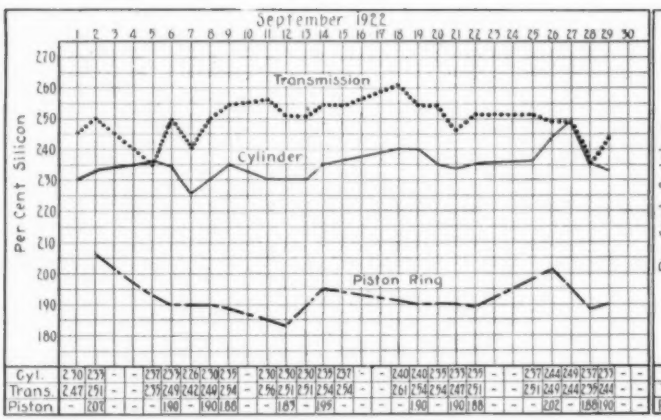


FIG. 3—CHART SHOWING THE DAILY SILICON CONTENTS OF THE IRON FOR SEPT., 1920

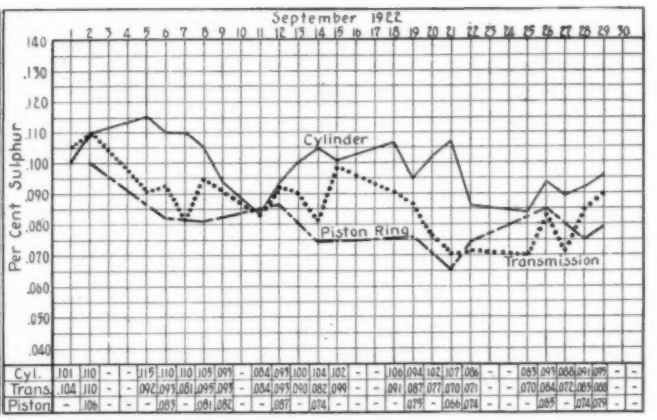


FIG. 4—CHART SIMILAR TO FIG. 3, SHOWING THE DAILY VARIATIONS IN SULPHUR

head for delivering cold air in front of the cupola doors to make charging easier in hot weather.

The blast for the cupolas is furnished by positive pressure blowers. The blowers are arranged in such a way that by operating suitable gates any cupola can be blown with any one of two or more blowers, so that it is impossible for the breaking down of any blower to stop melting operations. The practice is to use 9500 cubic feet of air per minute for each of the larger cupolas, and this volume is accurately determined by means of a volume blast meter supplied by the Chas. J. Clark Blast Meter Co., Gladsbrook, Ia. The charges consist of 3500 pounds. Each of the larger cupolas have a capacity of 17 tons per hour.

FIG. 5—GENERAL VIEW OF THE CUPOLA CHARGING FLOOR

For tapping iron a 3-ton receiving ladle, with skimming spout, is placed in front of the cupola, and this pours directly into a 1000-pound bull ladle on the monorail. These 1000-pound bull ladles hang on a monorail scale, which reads on the dial shown at the left, so that the operator in charge of the receiving ladle can put a predetermined amount of metal into each bull ladle.

A careful study has been made of the number of pounds of metal required to pour a given number of castings of a certain kind, and each ladle is filled to take care of the castings it is to pour. A designating number is then hung on the ladle, and this designates not only the composition of the metal it contains, but the destination, so that as it is pushed through the foundry, everyone makes room for it, and sees that it arrives at its destination in the least possible time. This arrangement also does away with the possibility of getting the wrong kind of iron into a given mold. It will be realized that this is particularly necessary when we consider that there are five cupolas in a line at the end of the shop, several of which are in blast at a time, usually each cupola is melting a different mixture of iron for various floors.

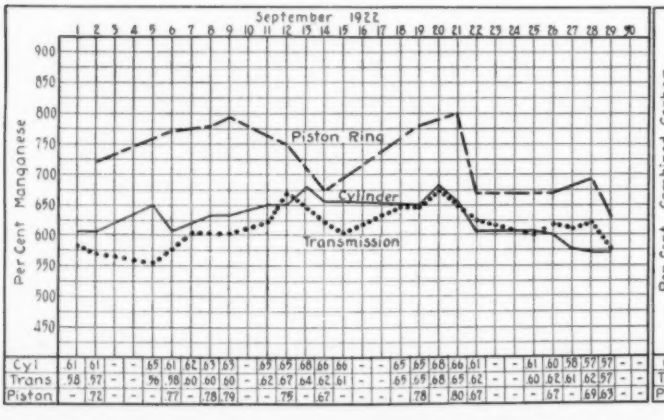


FIG. 6—CHART SHOWING DAILY VARIATIONS OF MANGANESE IN THE IRON DURING SEPT., 1920

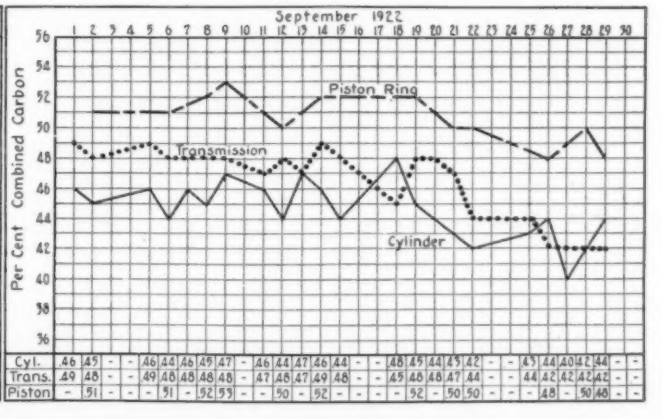


FIG. 7—SIMILAR CHART GIVING VARIATIONS IN COMBINED CARBON

Any mixtures requiring a considerable tonnage are made up on the charging floor, and the molten metal that comes down is of the proper composition, but a number of castings require a slight variation from the standard mixture, and to take care of this additions are made to the ladle. Tumbled steel scrap which is accurately weighed into small charges, is used to reduce the carbon in the iron, and soft iron castings are used for temperature control. Ferroalloys also are added in the ladle.

It is the practice of the Wilson plant to cast 1-inch square test bars, 14 inches long, which are broken on centers 12 inches apart. Where tension tests are necessary, the pieces for this are turned from the ends of the broken bar. Another bar is cast 12 inches long in a metal yoke. The ends of this bar are chilled, and by splitting the end the depth of the chill readily can be seen. This bar also gives the shrinkage, and this with the depth of chill gives an indication of the mixture before analysis has been completed.

Castings Poured Direct

Many of the castings are poured direct from the ladles filled at the cupola. Transmission cases are poured from a 1000-pound ladle held on an air hoist of a traveling crane. The ladle is brought from the cupola to the crane on a trolley, and is transferred to the air hoist by means of a two-way hook. Of course, some of the work is better poured with hand ladles, and in this case metal is taken to the floor in a bull ladle, and then transferred to hand ladles.

This company not only makes automotive castings, but turns out a line of cast-iron rubber tire molds. These are made on a large rollover machine. The tire molds require a special iron which is melted for them.

The laboratory not only has control of the metallurgy and of all the incoming material, but furnishes the specifications for their purchase, and analyzes and inspects it before it is unloaded and received. The backbone of all general mixtures used in this plant is what is known as No. 2 malleable pig iron, and this and several of the other grades of iron vary somewhat in composition as received. Hence as each car is analyzed the material is segregated into groups and piled accordingly, and later the material from these various groups is blended to obtain the desired results in the mixture.

Some of the reports kept in the laboratory are undoubtedly of interest. Fig. 1 shows a report of the gray iron foundry operations that is gotten out each month for the benefit of different members of the staff. The segments of the circle show the percentages taken up by the various products coming from the melt. The loss includes the difference between pounds of metal purchased and pounds of castings sold. The various classes of scrap from the pig beds, gate sprues, and foundry scrap are naturally returned to the cupola for remelt. The dotted area indicates the machine shop scrap return for the corresponding month, and naturally this also passes to the cupola for remelt. The remarkably low scrap loss maintained in this plant is due to the eternal vigilance not only of the laboratory, but of those in charge of equipment throughout the entire plant. Fig. 2 is a similar chart applying to the aluminum foundry.

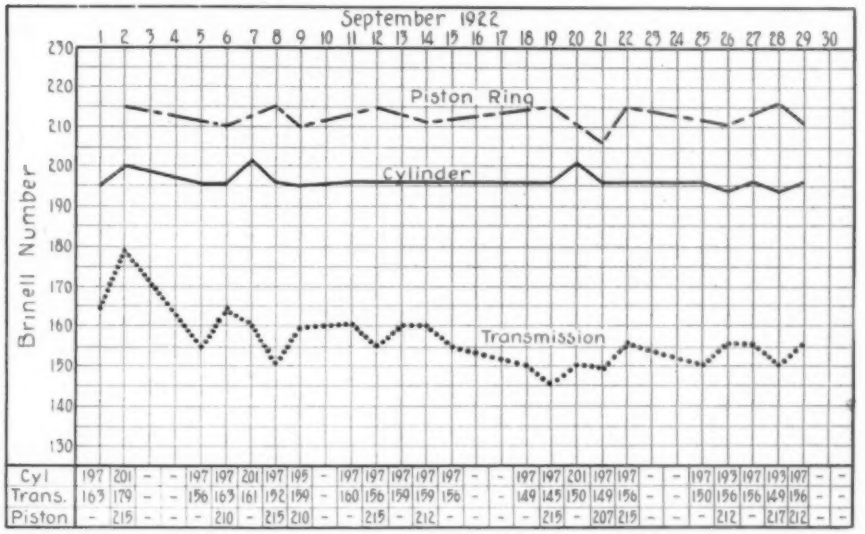


FIG. 8—BRINELL HARDNESS TEST CHART FOR THE MONTH OF SEPT., 1920

Each month charts also are made showing the variations of different elements, as shown by the daily analysis, but in this case particular attention must be called to the fact that in order to take advantage of the raw material available it is frequently necessary to juggle certain elements to maintain the desired combined carbon, brinell test, or some other physical requirement, and whenever a given element is juggled it is generally necessary to juggle certain other elements in the opposite direction to obtain the required result. This gives curves that are not as smooth as they would be were it possible to obtain absolutely uniform grades of iron.

Fig. 3 shows the silicon curve for the three principal classes of castings for the month of September, 1922; Fig. 4 the sulphur curve; Fig. 6 the manganese curve and Fig. 7 the combined carbon curve. Particular attention is called to the closeness to which this curve is controlled. Fig. 8 shows the brinell test.

Netting Ratios Charted

Some other curves that may be of interest are shown, Fig. 9 giving the total amount of coke and iron used for the first eight months of the year, 1922. The right hand portion of this diagram shows the ratio between coke and metal melted. Fig. 10 shows the total amount of molding sand and core sand used, and the ratio between the number of pounds of iron produced and the amount of sand used.

All analyses are made from samples obtained by drilling the test bars. On

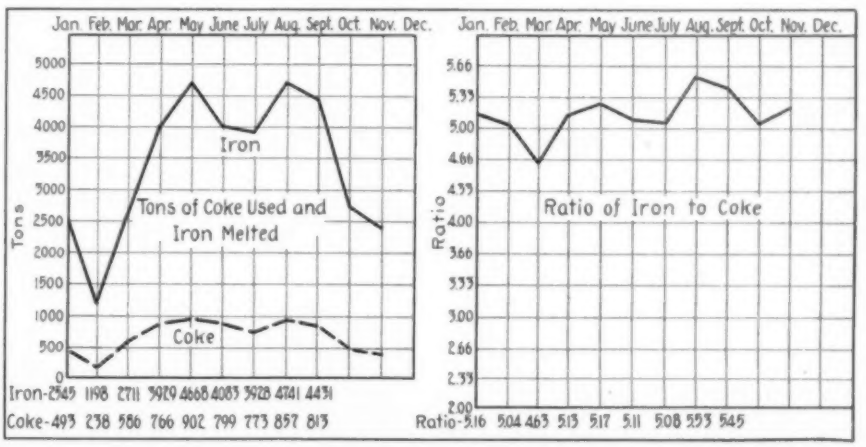

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Tons
Iron
Tons of Coke Used and Iron Melted
Coke
Iron-2545 1198 2711 3929 4668 4083 3928 4741 4431
Coke-493 238 586 766 902 799 773 857 813
Ratio
Ratio of Iron to Coke
Ratio-5.16 5.04 4.63 5.13 5.17 5.11 5.08 5.53 5.45

FIG. 9—CHART SHOWING THE AMOUNT OF METAL MELTED WITH THE AMOUNT OF COKE USED, TOGETHER WITH A MELTING RATIO LINE, ALL FOR THE YEAR 1922

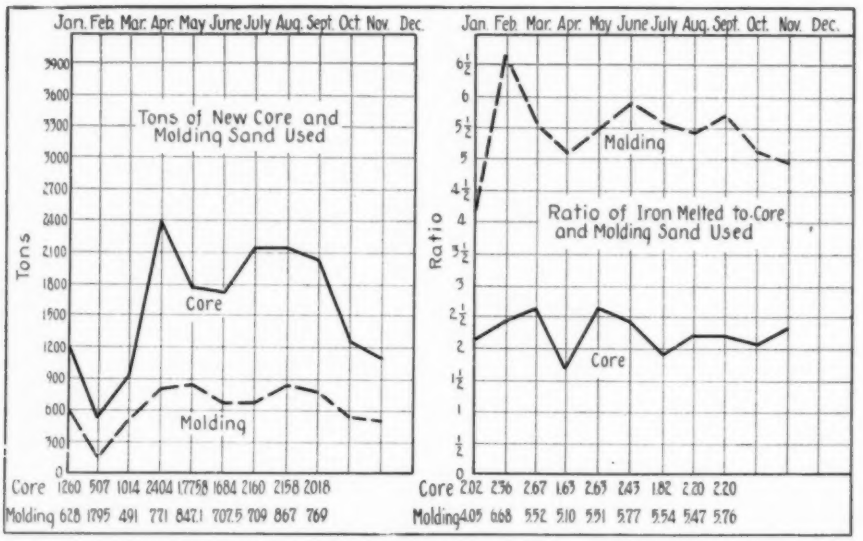

Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Tons of New Core and Molding Sand Used
Tons
Core
Molding
Core 1260 907 1014 2404 17758 1684 2160 2158 2018
Molding 628 1795 491 771 8421 7075 709 867 769
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Molding
Ratio of Iron Melted to Core and Molding Sand Used
Ratio
Core
Core 2.02 2.36 2.67 1.63 2.63 2.43 1.82 2.20 2.20
Molding 4.05 6.68 5.52 5.10 5.51 5.77 5.54 5.47 5.76

FIG. 10—DIAGRAM SHOWING THE CONSUMPTION OF MOLDING AND CORE SANDS, AND THE RATIOS OF CORE AND MOLDING SAND TO IRON

all standard mixtures a test bar is cast every hour, and on special mixtures, every 20 minutes.

Limestone equal to 3 per cent, and fluorspar equal in weight to 5 per cent of the metal is added on each charge. The cupola practice is aimed to give 5.5 pounds of iron per pound of coke. The diagram shown in Fig. 9 gives the coke ratio for the entire plant during the year 1922. This is affected more or less by the number of cupolas in blast, and the amount of bed coke which has to be distributed over the entire melt. Thus a thorough mixture of the melted metal may be secured before it is tapped.

Makes Record Run

For the piston iron a cupola is used which has been lined down to 36 inches in diameter, so as to melt 1000-pound charges. The well of the cupola will hold about 3000 pounds of metal, or three charges. The transmission iron is melted in the larger of the two cupolas of the old battery, and in this case 2500-pound charges are used. The record mark for melting in this plant was made in January, 1920, when the daily melt averaged 360 tons.

It already has been mentioned that the molding and core sand are under the control of the laboratory. The laboratory determines the proper time for mixing each batch. All sand heaps are inspected each day, and a moisture and porosity test made. The moisture determination is made by treating a weighed quantity of sand for evaporation of moisture between the temperatures of 100 and 101 degrees Cent. The porosity test is made by a special instrument. The principle on which this instrument works consists in splitting a flow of compressed air between two orifices. Any resistance that is felt at one of these orifices will naturally increase the amount flowing through the other orifices and raise the pressure shown on the gage used in connection with the instrument. An example of the test made for one day, and the results obtained therefrom is given in the following list:

		Percentage openess	Percentage moisture
Sand slinging machine No.	1	24.0	5.94
Sand slinging machine No.	2	23.5	5.75
Sand slinging machine No.	3	23.5	6.80
Floor slinging machine No.	5	25.6	5.45
Floor slinging machine No.	7	22.3	7.25
Floor slinging machine No.	12	21.7	8.17
M-4 flywheel facing.....		15.4	7.93

With the reading shown in this table no castings were reported with blows. However, at one time when this practice was being developed one of the molding floors showed an openess reading of between 17 and 18, and a moisture content of between 9 and 10 per cent, and this resulted in 10.15 per cent of the castings showing blows. In this connection it may be of interest to state that the openess is to a large extent dependent upon the moisture, as an increase of moisture always gives a lower reading, which indicates greater density.

Flows in Straight Line

It has been noted that the plant is arranged with the incoming sand arriving at one end next to the core room. All sand supplies and cores enter the foundry from this end. The melting stock comes in at the opposite end and side, and the molten metal is delivered to the floor by a series of monorail tracks. Through the foundry are a number of broad gangways for taking out the product, so that the flow of all material is essentially a straight line, and no back tracking is necessary. The castings are gathered on trucks which are pulled by a tractor. One of these trucks is shown at the shakeout conveyor in Fig. 11. The castings are unloaded from the truck by means of an air hoist, and are swung on to a slat carrier. Men standing along both sides of the slat carrier knock off the sprues, and dig out or knock off the principal cores. The slat carrier is continuous through the knockout and a tunnel under the railroad tracks to a point in the cleaning room proper. As the castings come off from the end of the carrier they are picked up with the tongs on the air hoist shown, and are swung on to a car that takes them to the tumbling barrels or sand blast. The broken cores and sand knocked from the castings are put through the sand reclaiming barrels, and then are taken by bucket elevators to the bins overhead.

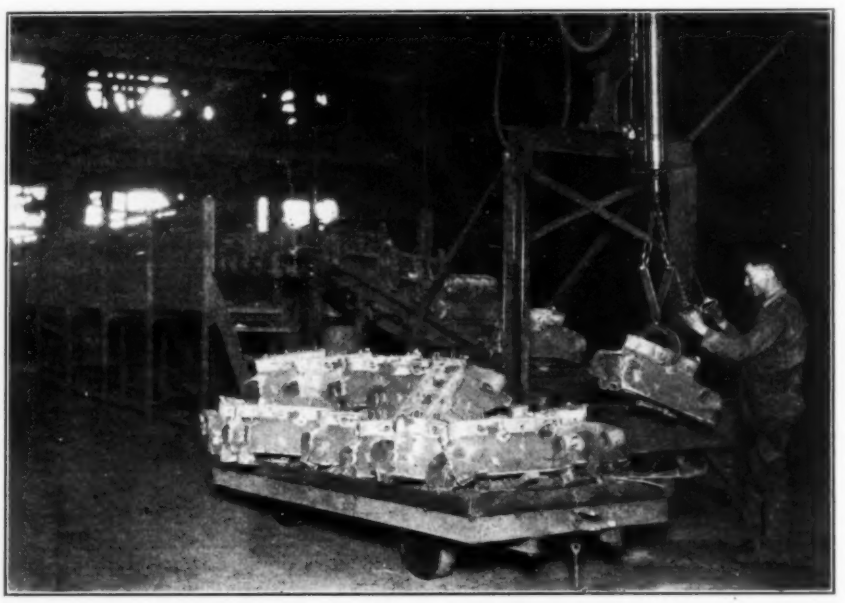


FIG. 11—LOADING END OF THE SHAKEOUT CONVEYOR
Castings arrive from the foundry on flat cars as shown and are lifted by an air hoist, the sprues broken off and the cores knocked out by men on both sides of the conveyor

With certain core mixtures it has been found possible to reuse a portion of the sand, while in other cases it is cheaper to recover the wires, rods, etc., and send all of the sand to the dump. With the sand handling equipment two men take care of all of the waste sand coming from the knockout. Spouts from the storage hopper extend into the foundry to deliver sand to cars which carry it to the core room, while other spouts on the outside of the building deliver the waste sand to railroad cars.

The tumbling barrels used are of the regular standard type, as is also the sand blast equipment. Castings after they are cleaned are chipped and inspected and then are delivered by a gravity carrier to a point opposite the slat carrier which takes them up into the machine shop.

Molds a Track Curve Without Pattern

BY. J. H. EASTHAM

WORKING conditions and transportation methods in a small jobbing foundry sometimes may be improved to a considerable extent at a trifling cost and without interrupting operation. For example, consider the conditions in a fairly well laid out building equipped with all the necessary conveniences with the exception that no provision was made for conveying the castings from the molding floors to the cleaning room. The industrial track indicated in the accompanying illustration was not installed until the fifth year of the plant's existence. The smaller castings were moved in wheelbarrows and the larger castings by the primitive pipe roller and pinch bar method. With a view of installing an industrial track the full length of the foundry down the center and with a turn at each end leading respectively to the sand storage and the cleaning room, the manager attended a junk sale and picked up several sections of light steel rails, a pair of dilapidated turntables and a number of ties, most of them rotten.

The straight rails were laid to a 22-inch gage and spiked inside and out on the best of the old sleepers cut down to 36-inch lengths. The turntables were so worn that it was decided to scrap them and in their place substitute a 90-degree bend at each end of the foundry. The sleepers and rails comprising each bend were cast in one piece without the aid of either pattern or flask.

An open sand bed approximately the proper area for the desired casting was leveled by four straight edges laid down in the order shown in Fig. 1. Nos. 1 and 2 first were leveled in the usual manner and then Nos. 3 and 4 were set through the agency of No. 5. After the bed was prepared rectangular lines were drawn on the surface at a 90-degree angle to each other. The apex of the angle served as a center from which to strike an 8-foot radius corresponding to the outer one of the proposed rails. A wedge was driven in the floor to serve as a stable center point and the familiar nail and string employed in place of a pair of compasses or trammels.

Two arc lines were scribed on the bed, one 8 feet radius and the other 22¼ inches less. These lines served as guide lines in locating two pieces of core 1¾-inch square employed in lieu of patterns. If the foundry had been operated in connection with a pattern shop wooden segments of the desired shape readily could have been sawed on the band saw. Sand was rammed around the core segments and they were moved steadily forward from one side of the bed to the other until the proposed molds for the rail segments were finished. The molds were covered with a number of cover cores with the usual type of interlocking ends. Additional cores laid on top at the desired points made the molds for the cross bars or ties. These spaces were left open and were used as runners when the time came to pour the metal. Details are shown in plan and section in Fig. 2.

The metal was poured from eight hand ladles uniformly distributed so that the mold filled evenly and rapidly. Tests made after the rails were placed in position with sand rammed under them showed that they were quite safe under a 2-ton load. A flat car equipped with wheels on 20-inch centers encountered no difficulty in making the turn on the finished tracks.

The American Steel Foundries just has completed at its Chester, Pa., plant, what is believed to the largest anchor ever made in this country. It weighs 33,300 pounds and is for the steamship LEVIATHAN now being overhauled at Newport News, Va.

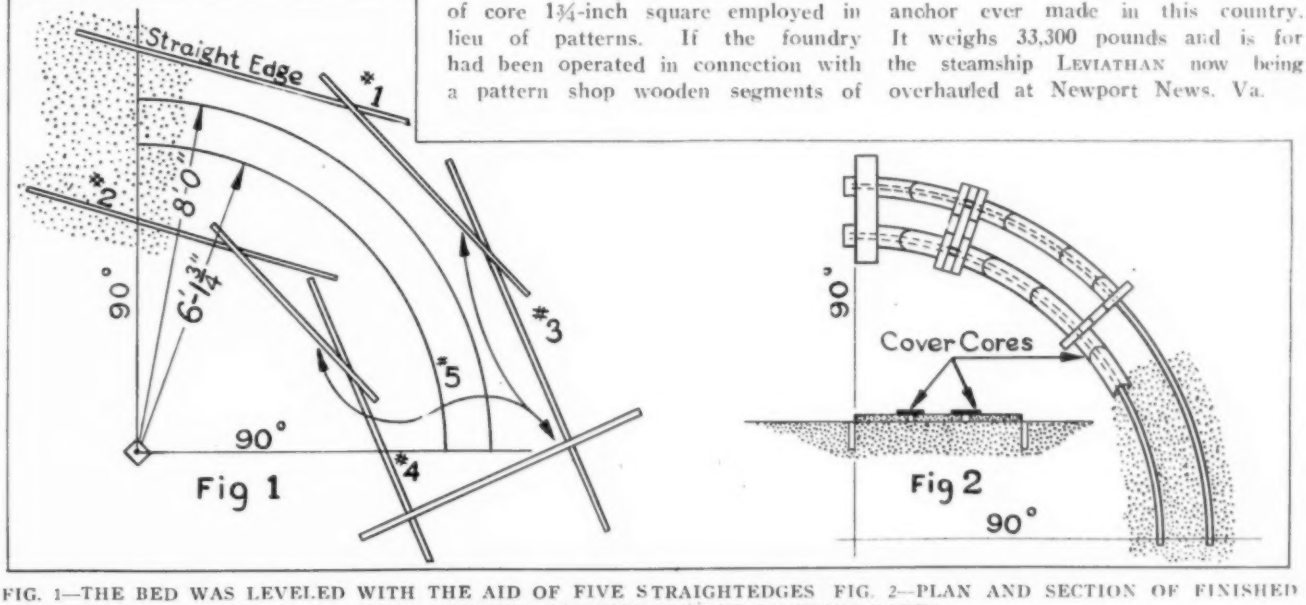


FIG. 1—THE BED WAS LEVELED WITH THE AID OF FIVE STRAIGHTEDGES FIG. 2—PLAN AND SECTION OF FINISHED MOLD SHOWING DISTRIBUTION OF COVERING CORES

Oxyacetylene Torch Cuts Iron

Large Percentage of Impurities in Cast Iron Hindered the Development of a Successful Gas Cutting Process, but Torches Have Been Perfected so that the Metal Now Can Be Cut Readily

BY. A. S. KINSEY

MANY valuable applications of the oxyacetylene torch to the cutting of cast iron have developed since it was found about two years ago that this metal could be cut satisfactorily by the flame. There had been some difficulty in obtaining practical results at first, due principally to improper design of torches and tips. As was shown, however, an intermediate pressure cutting torch will cut cast iron satisfactorily, with modifications required only in the tip. In fact, a new tip just designed for such work will cut cast iron better than the writer has ever seen it done before.

Of course, it was hardly to be expected that there would be as great need of the oxyacetylene cutting torch for cast iron as there has been for low carbon steel, and any hesitancy to use the torch on cast iron would be but a repetition of the general attitude toward the oxyacetylene torch when it first was offered as a means for cutting steel. No one now questions the value of the cutting torch on steel, and it will not be long before the cutting of cast iron by the same principle of oxidation will be just as readily accepted. The justification for this belief lies chiefly in the fact that although until within the past few weeks the so-called cutting of cast iron was probably a melting action, as much as one of oxidation, it is now possible to do the cutting as completely by oxidation as is done in the cutting of steel. We will refer to this again.

As would be expected the railroad locomotive shops were quick to see the advantages of cutting cast iron with the torch, especially when this could be done with but the slight additional expense of the cost of only a special tip. About the first job attempted, therefore, was the scrapping of obsolete and worn out locomotive cylinders. At one time it was customary to break up these cylinders with the skull-cracker, a heavy cast iron ball hoisted 25 to 50 feet and allowed to fall upon the cylinders, but safety committees have prohibited this practice unless a high brick safety wall is built around the break pile to prevent flying pieces of the castings from injuring workmen. Most railroads have not had the available funds for this improvement, and as there was no other way to break up the cylinders they were stored in an out of way place.

The cutting torch is now being used to reduce these castings to charging-door size of scrap so that they may be melted in the cupola and added to the supply of good quality cast iron for the needs of the foundry. The cutting can be done in the scrap yard regardless of cold weather, and but little practice is required for a man to be able to do the work. It is true that the first cost of such cutting appears to be higher than that of the quick breaking of the casting with a skull-cracker, but on the other hand careful analysis of the cost for power, labor and repairs of the skull-cracker outfit will show that it is no more economical than the torch cutting.

One of the most serviceable pieces of cast iron cutting being done in the locomotive shop is that of removing bushings from the cylinder barrels and the valve chests. When a cylinder has worn too large in diameter the common practice is to reduce the inside diameter so that it again will fit the piston, by forcing into it a ring of cast iron, called a bushing, the full length of the cylinder bore. However, after a time this bushing becomes worn too large and it must be removed to make room for a new bushing. Until recently this has been done by chipping it out with hammer and chisel. The oxyacetylene torch is now used for this work, and can remove a main cylinder bushing in about 15 minutes as compared with about 3 hours with a chisel. The details are as follows:

	With torch 15 minutes	With chisel 3 hours
Oxygen	$0.85	....
Acetylene	0.03	....
Labor	0.20	$2.40
Total	$1.08	$2.40

Two cuts the length of the bushing must be taken in both methods. The oxyacetylene cutting can be done without injuring the cylinder walls. In the case of cutting out valve chest bushings with the torch, three equidistant lengthwise cuts should be made to avoid marring the ports and bridging.

In a shipyard a heavy broken cast iron propeller is much in the way. The hubs are often too thick to break with a skull breaker; sometimes they are buried, or dumped into a swamp, but in city shipyards they often remain in the way. This condition need not continue, as they can be cut up with the oxyacetylene torch.

The following data were obtained from cutting a propeller hub weighing 5 tons and requiring two cuts each 20 inches long through thicknesses varying from 7 to 12 inches.

Oxygen	$14.00
Acetylene	6.00
Labor, 2 hours	1.56
Total	21.56
Value of hub as scrap, about	100.00
Additional advantage	Out of way
Length of two cuts	40 inches
Thickness of cut	7 to 12 inches

Ordinary gates and risers of iron castings are usually broken off by a blow of a hammer, which is the most economical way. There are times, however, when big gates and risers have been improperly molded, or they may have a diamond-shaped end. It requires a big fire to cut cast iron by torch and the walls of cast iron pipe are so thin the heat from the oxyacetylene flame goes through the metals so quickly that the burning, or cutting, progresses rather slowly. A new design of torch tip has overcome this trouble, and the cutting of cast iron pipe with the torch will undoubtedly soon become common practice on water, gas, drainage and other uses of such pipe.

One of the most serviceable uses of the cutting torch is for beveling the edges of cast iron to be welded. The oxide scale left on the bevel by the torch may easily be shattered loose with a hammer, and the metal is not injured by the action of the cutting torch.

Recent figures show that the cost of cutting thick cast iron with the oxyacetylene torch is about four times that of cutting steel, the thicker

Paper presented at the December meeting of the Metropolitan section of the American Welding society, New York. The author is advisory service engineer, Air Reduction Sales Co., New York, and professor of shop practice, Stevens Institute of Technology, Hoboken, N. J.

metals being more economically cut than the thin ones.

In some of the latest cutting of cast iron a rate of about 10 square inches per minute was made in a cut 13 inches deep by 14 inches long. This would cost say 1 cent for labor, 12 cents for oxygen, and 3.5 cents for acetylene, making a total of 15.5 cents to cut 10 square inches per minute.

Steel 12 inches thick can be cut at a rate of about 30 square inches per minute, which would cost 1 cent for labor, 9 cents for oxygen and 1.5 cents for acetylene, a total of 11.5 cents to cut 30 square inches per minute.

To make these figures comparable with other cutting data we will compute them for cutting 100 square inches by hand torch.

CONSUMPTION

Material	Time min.	Oxygen c. f.	Acetylene c. f.
Steel	3.33	25	2
Cast iron	10	100	15

COST

	Labor	Oxygen	Acetylene	Total
Steel	$0.04	$0.30	$0.05	$0.39
Cast iron	0.10	1.20	0.35	1.65

Of course, this comparison should not end with these figures for if it were not possible to cut cast iron with an oxyacetylene torch it would have to be done by machinery. This would cost about $5.00 to cut off a section of 100 square inches. The torch will serve efficiently in these cases, and the cutting may be done close up to the casting without affecting the carbon balance of the iron and hardening the surface.

The cast iron tanks used in chemical plants sometimes requires a new bottom put in them. The old bottom can easily be cut out with oxyacetylene torch. The big cast iron bowl-shaped vessels used in nonferrous metal foundries, die and chemical plants and other places, wear out and must be removed and scrapped. Some of these vessels are 12 to 15 feet in diameter and are difficult to get out of the building. They can be cut in position with the torch, small enough to be sent to the cupola for remelting.

Sometimes it is desired to shorten the cast iron base of a big machine or such a base is located in a subbasement and must be scrapped, or the cast iron bed plate of an engine needs to be altered, or an opening must be made in some such casting down in a crowded engine or machine room. The oxyacetylene torch is proving invaluable for this sort of work, often avoiding serious delays in power and lighting plant operation. Until recently the cutting of cast iron pipe with the oxyacetylene torch could not be done as cheaply as by diamond pointing, that is, cut by hammer and a chisel having machining cost about three times as much as the torch cutting.

To summarize, the comparative cost of cutting 100 square inches of metal is as follows:

Metal	Cut by	Cost per 100 sq. in.
Steel	Oxyacetylene torch	$0.39
Cast iron	Oxyacetylene torch	1.65
Cast iron	Machinery	5.00

Procedure in Cutting Iron

To cut cast iron it is necessary to observe the following rules:

1—Use a special tip in a regular torch for cutting steel if it is of the medium type.

2—Use the size of tip and the oxygen and acetylene pressures given in the following table.

Number of tip*	Thickness of metal	Oxygen pressure, lb.	Acetylene pressure, lb.
1	½"	20	4½
1	¾	30	4½
2	1	30	5
2	1½	35	5
2	2	45	5
3	3	55	7
3	5	75	7
4	7	95	9
4	9	125	9
5	10	130	10
5	15	150	10

*Type of tip made by the Air Reduction Sales Co., New York.

3—The flame should be about 2 inches long and be made carbonizing with an excess of acetylene.

4—Warm the casting near the cut for a few seconds with the oxyacetylene torch.

5—Start the cut at the bottom, directing the flame toward the cutter, and slanting the tip forward so that the flame strikes the bottom corner of the casting at an angle of about 45 degrees. Then after the cut gets well started gradually pull the torch toward the casting so that the cutting angle will change to a vertical position. As soon as the cut has penetrated the full thickness of the casting the tip should be slanted about 45 degrees, which will cause the sparks to be thrown away from the cutter. This will make the actual depth of cut about 18 inches, which can be accomplished quite satisfactorily.

6—If the cut is deep a helper should stand at the cylinders to keep up the oxygen and acetylene pressures.

7—The cut should be made by spiraling the tip, that is, instead of holding the torch steadily, as in the cutting of steel, give it a spiral motion so as to widen the cutting groove, called the *kerf*, allowing the flame free access to the metal, and get the slag out of the way quickly. Or the tip can be slightly swung from side to side to widen the kerf.

8—The cutting should be done at a speed which will leave no slag bridges across the kerf. The pieces should freely drop apart at the end of the cut.

9—As soon as the cut is made, cover the hot ends with asbestos, or dry sand, and do not knock off the slag scale until the metal is quite cold. These precautions will keep the cast iron soft and machineable. If the ends are not to be machined then they do not need to be covered, and the scale may be knocked loose while still hot.

10—The cutter should take extra precautions to protect himself against the unusual heat.

Much heat and smoke is produced in the cutting of cast iron as compared with the cutting of steel. The kerf must be made three or four times wider than that for steel, which requires the burning of a larger amount of the pure iron, called ferrite.

A liberal amount of slag scale is left on both cut surfaces of cast iron, which is a fortunate condition, as it prevents the iron from becoming too hard to machine.

The fact that the heated surfaces are but little harder after than before cutting is done, indicates that there has been but slight change in the carbon of the cast iron. Undoubtedly the oxide scale left by the cutting action serves as an insulator of the hot metal from the cold air, and allows it to cool slowly enough to cause the proper proportion of combined carbon to change back to graphitic carbon.

Ordinary iron castings contain graphitic and combined carbon. Graphitic carbon softens and weakens cast iron, while combined carbon hardens and strengthens it. When cast iron is melted practically all of the carbon combines with the iron and none is left in the graphitic condition. If the iron is then allowed to cool quickly all of the carbon will remain in the combined state and the metal will be too hard to machine. However, if the cast iron is made to cool very slowly from the molten condition back to the cold solid casting, enough graphitic carbon will separate out to again equal about the original portion of the two carbons, and the casting will be soft and machineable.

Therefore, when cast iron is cut with the oxyacetylene torch the surfaces adjacent to the kerf are melted, or heated high enough to throw all the carbon in the combined state, and if the casting were allowed to cool quickly the cut surfaces would be too hard to machine. This is prevented by the heavy oxide scale which is formed from the cutting of the metal and which completely covers the two surfaces, thus insulating the hot metal from the cold air and causing a slow cooling. In the cutting of some cast iron the scale may not be thick enough to produce sufficient final softness, in which case it

would be well to cover the cut ends with asbestos paper. Of course, the oxide scale should not be disturbed until the casting is cold to the hand, when the scale may easily be shattered loose by a hammer blow.

Previous to about two years ago, it was generally believed that cast iron could not be cut with the oxyacetylene torch. At that time some interesting experiments proved that cast iron could be cut, and it was concluded that the cutting was accomplished by a combination of oxidation and melting. While the deposit from the cutting was largely oxide ash, there was also a liberal amount of molten iron in it. It was therefore concluded that complete oxidation or burning of the metal, similar to that accomplished in the cutting of steel, was impossible, although the metal could be satisfactorily cut with the oxyacetylene torch.

Complete Oxidation Possible

It will be of interest, therefore, to learn that recent experiments in the cutting of heavy cast iron were accomplished with as perfect oxidation of the metal as is usual in the cutting of steel. That is, there is now good reason for believing that cast iron can be oxidized just as completely as steel if the proper design of torch and tip are used.

The cutting last referred to was about 13 inches deep by 14 inches long, although when the cut was properly started and the cutting angle of 45 degrees was gotten the depth of the cut was about 18 inches. The casting had been taken at random in a scrap yard, and its chemical composition was not known. The oxide deposit from the casting was free of molten iron and could easily be crushed between the fingers. The kerf surfaces showed the best cutting of cast iron the writer has seen. The cutting was done with our latest model cutting torch for steel, fitted with a new design of tip for cutting cast iron.

It is evident, therefore, that the only reason cast iron has not been cut by complete oxidation heretofore is because the tip was not properly designed to accomplish the work.

From the first cutting of cast iron it was found that the best flame was a carbonizing one using a liberal excess of acetylene, and the new tip is designed to take advantage of this.

In the light of the latest results of the cutting of cast iron it may be of interest to compare the oxidizing conditions of that metal with steel. In the cutting of steel a spot is made red hot (this temperature has been determined to be about 1800 degrees Fahr. for wrought iron and low carbon steel) with the preheating flame, and then the high pressure oxygen of the torch is snapped on. This starts cutting action and a groove is burned or oxidized through the metal.

Now it is well known that the less the amount of chemical impurities in the metal the easier it may be cut. So wrought iron containing only about 0.25 per cent impurities would cut more readily than steel containing about 0.85 per cent impurities, while cast iron with about 7.0 per cent impurities would be the hardest of all to cut. The principal impurities in all these metals are carbon, silicon, manganese, phosphorus and sulphur. It is quite probable that carbon is the particular chemical element which affects the cutting. Wrought iron contains only about 0.02 per cent, low carbon steel about 0.20 per cent and cast iron about 3.50 per cent carbon.

Cutting Action Slowed Down

It is generally thought that the graphitic carbon lying in flake form between the grains of cast iron tends to interfere with the burning of the iron and thus retards the cutting action of the oxyacetylene torch. There is also the possibility of the comparative amount of combined carbon in the pure iron making it difficult to burn the iron. Again it may be that the high proportion of 2.5 per cent of silicon in cast iron to only about 0.05 per cent in steel may have a deterrent effect on the cutting.

Whatever may have been the cause of the difficulty heretofore, one thing is now certain, cast iron can be completely oxidized by the oxyacetylene torch even in thicknesses up to 18 inches.

Engineers Move Offices

A. A. Wickland & Co., Inc., foundry engineers, will remove their offices from 105 West Monroe street, Chicago, to the Mallers building, Madison and Wabash, April 21, to obtain larger quarters. In addition to engineering and consultation service, this concern will start the manufacture and sale of a newly completed cupola charging mechanism.

The Combustion Engineering Corp., New York, has acquired the Quinn Oil Burner & Torch Co. W. R. Quinn, former president of the Quinn Oil Burner & Torch Co., has been appointed manager of the fuel oil department of the Combustion Engineering Corp.

National Standards Being Adopted Rapidly

With 275 national organizations cooperating in the work of the American Engineering Standards committee, and more than 900 individuals serving on sectional committees, the work of approving national standards is progressing encouragingly. Of the 35 standards thus far approved by the committee the following are of particular interest to foundrymen:

Safety Code for the Use, Care and Protection of Abrasive Wheels.

National Safety Code for the Protection of Industrial Workers in Foundries.

Specifications for Electrolytic Copper Wire Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars.

Specifications for Lake Copper Wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars.

Methods of Chemical Analysis of Manganese Bronze.

Methods of Chemical Analysis of Gun Metal.

Chemical Analysis of Alloys of Lead, Tin, Antimony, and Copper.

Methods of Laboratory Sampling and Analysis of Coke.

Safety Code for the Protection of Heads and Eyes of Industrial Workers.

Conducts Welding Shop

The Pittsburgh branch of the Metal & Thermit Corp. will be moved from 801-807 Hillsboro street to 1514 Fayette street, Northside. A modern welding shop is being constructed at the new quarters and will be equipped with facilities for making thermit welding repairs and relining crucibles. A large stock of thermit equipment and supplies will be carried.

Germans To Exhibit

The Verein Deutscher Eisengiessereien will again hold a foundry equipment exhibition this year in Hamburg, Germany, from Aug. 19 to Sept. 2. The principal object of the exhibition is to promote scientific control of foundry work. The association's own exhibits will form the nucleus of the show. There will be an interesting exhibit of tested raw materials for castings, and also of finished products. The various mechanical and metallurgical processes will be shown in detail and exhibits in the allied spheres of steel and nonferrous metal founding will also be shown.

The Mott Sand Blast Mfg. Co. has removed its main office accessory and repair parts departments from 3101 West Twenty-seventh street to 24-30 So. Clinton street, Chicago.

Copper-Silicon-Aluminum Alloys

Numerous Sand Cast Mixtures Tested and Micrographs Made To Determine Effects of Various Proportions of Silicon and Copper—Shrinkage Lowered by Increasing the Percentage of Silicon in the Alloy

BY E. H. DIX, JR. AND A. J. LYON

DURING the past year, the engineering division of the air service, McCook Field, Dayton, O., has found by experiments that the addition of silicon to aluminum is advantageous as regards foundry practice. The alloys may be cast around hard cores without danger of cracking and the tendency to shrink and draw between thick and thin sections is much less than in most aluminum alloys. However, the silicon-aluminum alloys are difficult to machine. The low-silicon alloys tear in much the same manner as pure aluminum, and the high-silicon alloys not only tear but seem in addition to quickly dull the tools. For this reason, additions of copper were tried and found to greatly improve the machining qualities.

The ingot aluminum used in this investigation contained nearly 1 per cent of silicon and was chosen because this seemed to be a good opportunity for using a 98 per cent grade of aluminum ingot. Here the only impurity in excess was silicon, the copper and iron constituents being minute with the manganese element practically negligible. Complete analysis of this ingot is as follows:

	Per cent
Silicon	0.99
Copper	0.32
Iron	0.51
Manganese	nil
Aluminum (by diff.)	98.18

The silicon was added in the form of a silicon-aluminum hardener purchased from the Electrometallurgical Corp., Niagara Falls, N. Y. The following analysis was obtained:

	Per cent
Silicon	60.51
Copper	0.30
Iron	1.22
Aluminum (by diff.)	37.97

The copper was introduced in the form of a 50-50 copper-aluminum hardener made in our own foundry and having the following chemical analysis:

	Per cent
Copper	59.55
Silicon	0.17
Iron	0.21
Aluminum (by diff.)	40.07

The fifteen alloys were made up in melts of 40 pounds each. The aluminum ingot, copper-rich hardener and silicon-rich hardener were all charged together in a No. 40 plumbago crucible and melted in an oil-burning furnace. The temperature was measured by a thermocouple without a protecting tube, used in conjunction with a high-resistance millivoltmeter. The method of making the alloys was maintained uniform throughout the series, each melt being carried to just under 1400 degrees Fahr. with frequent stirring. The pouring temperature was maintained at 1300 degrees Fahr. plus or minus 20 degrees. The time in the furnace averaged about one hour. No flux of any kind was used. All of the test bars were poured from the original

Paper presented at the meeting of the American Society for Testing Materials held recently at Atlantic City. Mr. Dix is chief of the metallurgical branch and Mr. Lyon is metallurgist, both of the engineering division, United States air service, Dayton, O.

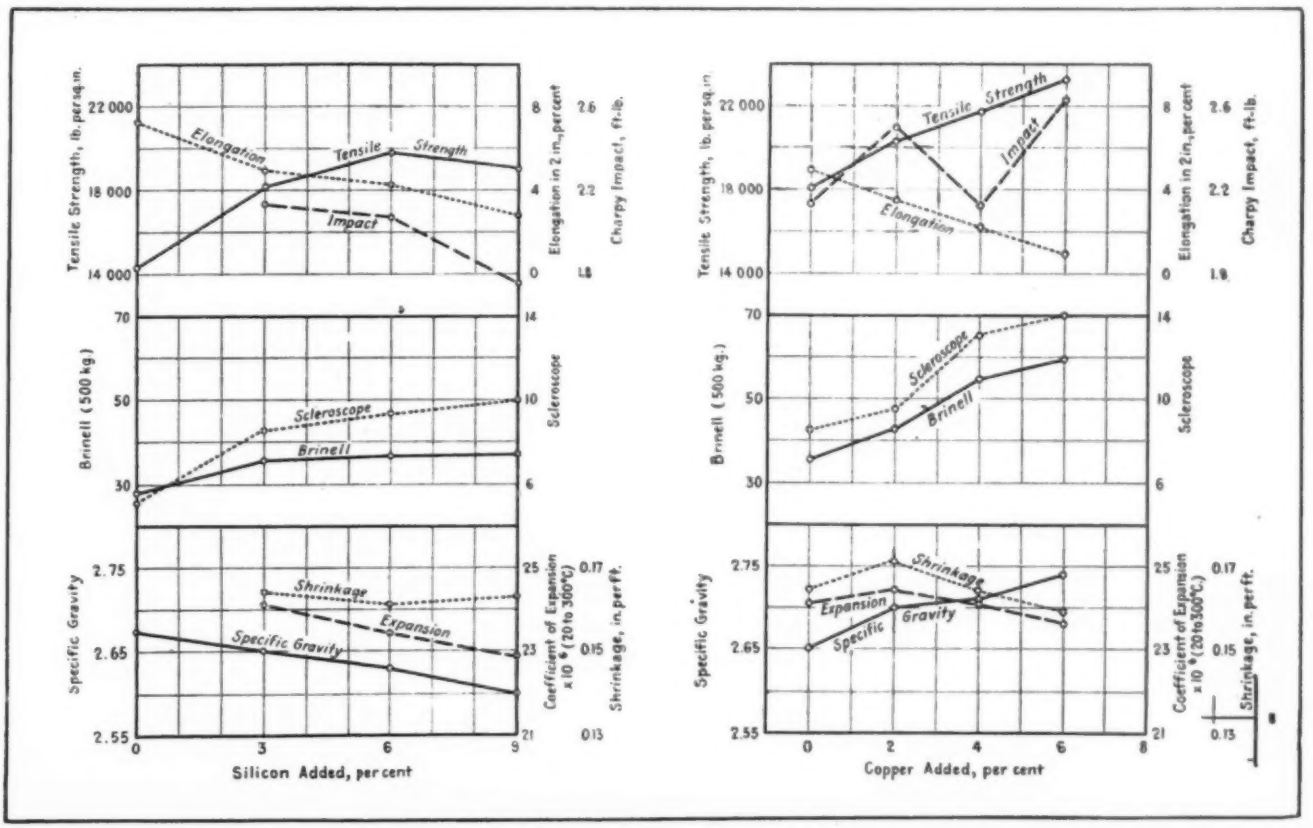


FIG. 1—EFFECT OF ADDITIONS OF SILICON TO ALUMINUM FIG. 2—EFFECT OF ADDITIONS OF COPPER TO A 3 PER CENT SILICON ALLOY

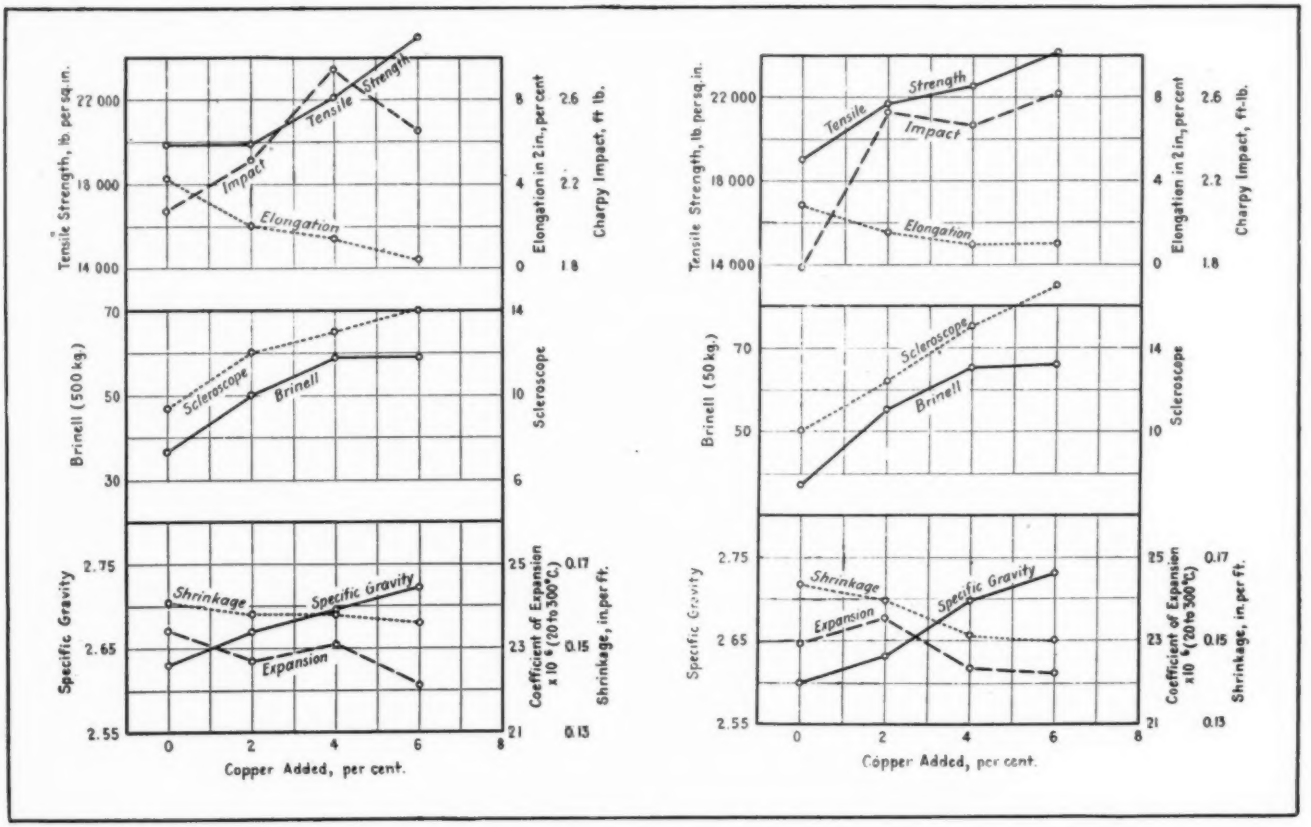


FIG. 3—EFFECT OF ADDITIONS OF COPPER TO A 6 PER CENT SILICON ALLOY

FIG. 4—EFFECT OF ADDITIONS OF COPPER TO A 9 PER CENT SILICON ALLOY

melt except the modulus of elasticity specimens, which were cast from a remelt in most cases.

To test the effect of silicon on the cracking tendency of the alloys, a hot shortness test was devised. This consisted in casting, in green sand, test bars with enlarged bosses at each end, around pins spaced 12 inches apart and firmly fixed in a heavy iron plate. The test bar was ½ inch in diameter over a length of about 2½ inches and then tapered gradually to a diameter of 1 inch at each end. The metal was led into one end of the test bar and risers were placed over each boss.

To obtain the pattern shrinkage of these alloys, test bars 1 inch square were

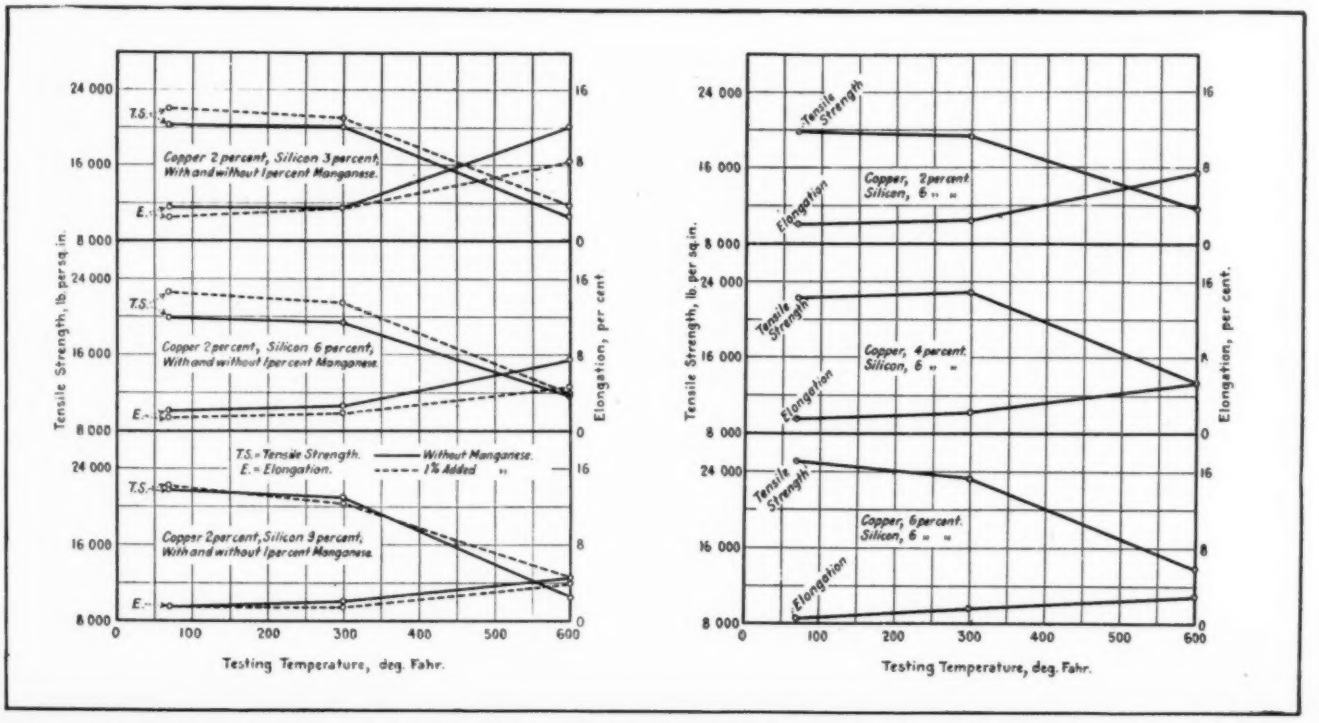

Tensile Strength, lb per sq.in.
Elongation, per cent
T.S.
E.
Copper 2 percent, Silicon 3 percent, With and without 1 percent Manganese.
Copper 2 percent, Silicon 6 percent, With and without 1 per cent Manganese.
T.S. = Tensile Strength.
E. = Elongation.
Without Manganese.
1% Added "
Copper 2 per cent, Silicon 3 percent, With and without 1 per cent Manganese.
Testing Temperature, deg. Fahr.

FIG. 5—TEMPERATURE TESTS SHOWING EFFECT OF ADDITIONS OF 1 PER CENT MANGANESE TO SILICON ALLOY

Tensile Strength, lb per sq.in.
Elongation, per cent.
Tensile Strength
Elongation
Copper, 2 percent. Silicon, 6 " "
Copper, 4 percent. Silicon, 6 " "
Copper, 6 percent. Silicon, 6 " "
Testing Temperature, deg. Fahr.

FIG. 6—EFFECT OF ADDITIONS OF COPPER TO 6 PER CENT SILICON ALLOY

cast in green sand molds containing graphite blocks at the ends, adjusted to exactly 12 inches between faces. Three test bars were cast for each melt. When cold their length was measured by a micrometer caliper and the difference between this length and their original length of 12 inches was taken as the shrinkage in inches per foot.

The test bars for physical testing were cast according to the standard practice of the engineering division, which consists in casting all bars horizontally in green sand with the mold slightly tilted so that the metal runs up hill. The metal is poured into a pouring sprue 1¼ inches in diameter and through gates into the test bars which are joined at the opposite end to a riser 1¼ inches in diameter. A 3-inch cope is used in all cases. The bars, which were tested *as cast,* were cast three in a mold. The bars, tested *machined,* were cast in a similar manner except that ⅛ inch machining allowance was made. The modulus of elasticity bars were cast two bars in a mold, ¾ inch in diameter over the gage length and tested without machining. The bars for the impact test were cast 9/16 inch square by 9 inches long. Four bars were cast in one mold and three specimens machined from each bar. The bars for coefficient of expansion tests were cast ¾ inch in diameter, two in a mold.

Tension tests* were made on the bars *as cast* in a 20,000-pound testing machine, using wedge grips. Five bars of each melt were tested. Elongation was measured over a 2-inch gage length, the diameter of which was approximately ½ inch. Specimens for modulus of elasticity tests were threaded and held in self-aligning adapters. The deformation was measured by a ewing extensometer. Two bars of each melt were tested. The high temperature tests were made on ½-inch diameter bars without removing the skin over the gage length, although the ends were threaded for self-aligning adapters. The tests were made in an electrically heated tube furnace. The temperature was obtained by a couple attached to the center of the specimen and used in conjunction with a potentiometer. Three tests were made at both 300 and 600 degrees Fahr. The impact tests were made in the charpy pendulum machine with a light-weight hammer having one-tenth the capacity of the standard hammer. The standard 10-millimeter square specimen with round drilled notch 5 millimeters deep and having a radius of 1 millimeter was used. Twelve tests were made from each melt. The brinell, scleroscope, and specific gravity tests were made on the end of all specimens tested *as cast;* a 500-kilogram load was used in the brinell test. The coefficient of expansion tests were made by the bureau of standards on one bar from each melt.

Chemical analyses* were made on all melts according to standard methods, and are given in the accompanying table.

Specimens for metallographic analysis were cut from the riser end of the bars to be tested *as cast* so that the structure is that of a ¾-inch diameter bar cast in green sand. No annealing was done. The specimens were prepared in the usual manner, except that the final polishing was accomplished by means of heavy magnesia powder and distilled water. The following four etching reagents were tried: 2.5 per cent hydrofluoric acid; 0.1 per cent sodium hydroxide; 20 per cent nitric acid at 70 degrees Cent., followed by quench in cold water; 5 per cent hot nitric acid. These reagents were found unsatisfactory except for special purposes, the structure being much more clearly revealed by careful polishing without etching.

The results of the physical tests are summarized in the form of curves, Figs. 1 to 7, inclusive, which are self-explanatory. The results of tensile strength, elongation and hardness tests given in these figures were obtained within 24 hours of casting but specimens tested one month later showed practically the same results. These results were obtained on specimens *as cast;* but tests were also made on machined specimens and these showed an average tensile strength 860 pounds per square inch lower than those tested with the skin on.

From Fig. 1 it is evident that the added silicon content should be between 3 and 6 per cent. It should be borne in mind that the original ingot used in these experiments contained 0.6 to 0.7 per cent more silicon than normal. When copper is added to the silicon alloys, it seems desirable to keep the silicon content near the lower limit given above, inasmuch as the alloys become less ductile with increasing silicon and the increase in strength is slight. Four per cent of copper seems to be the maximum advisable to use with the silicon alloys.

Referring to Fig. 7, it may be noted that in the alloys without copper, silicon has the effect of stiffening the curve beyond the apparent elastic limit, which is also raised. With a constant silicon content of 6 per cent, additions of copper also have a stiffening effect on the modulus curve beyond the apparent elastic limit. The modulus of elasticity of this series is between 10,000,000 and 11,000,000 pounds per square inch. Thus there are several desirable combinations which may be chosen with the copper and silicon, both between the limits of 3 to 5 per cent. If good elongation is desired without particular machining qualities the copper should be low. Where fine threads must be cut, or good machining qualities are desired for some other reason, the copper should be near the upper limit and the silicon low.

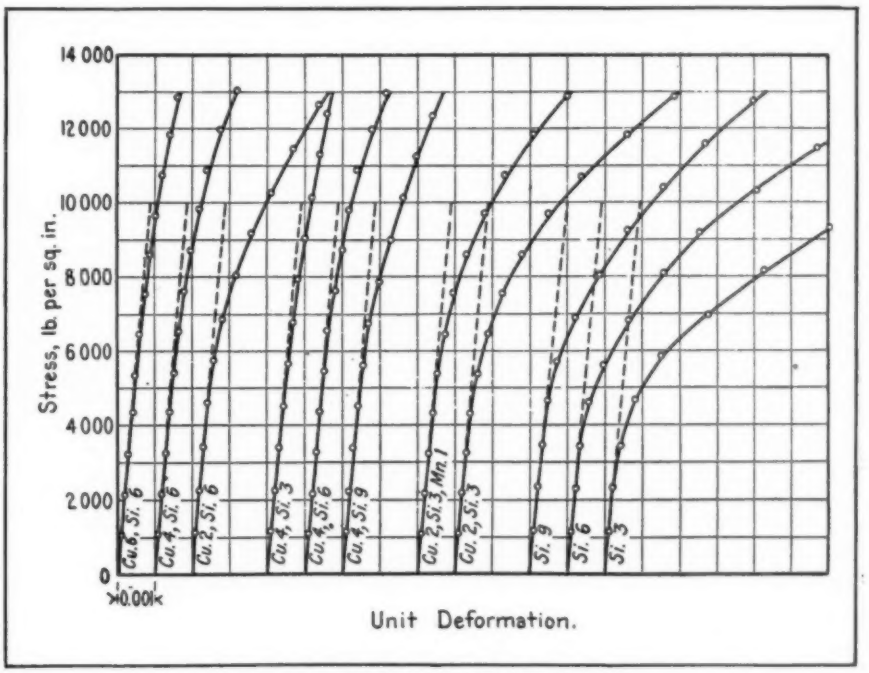


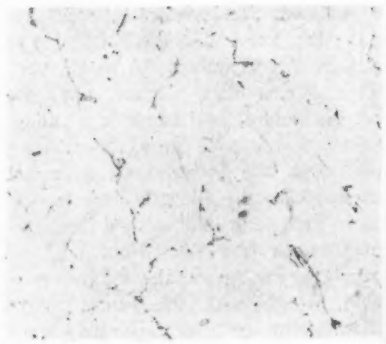
FIG. 7—STRESS-DEFORMATION CURVE

The effect of manganese as shown by Fig. 5 seems to be to raise the tensile strength at the expense of the elongation, but it does not seem to impart any particular resistance to high temperatures, as it is known to do with the straight copper-aluminum alloys.

Figs. 5 and 6 show that the straight

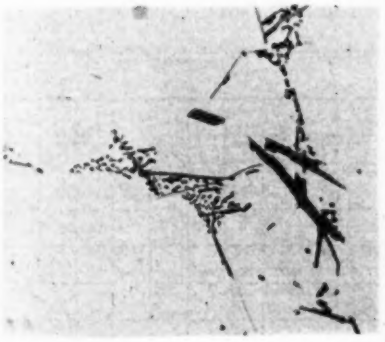
*Carried out under the supervision of R. R. Moore.

*Made under the direction of M. R. Whitmore.

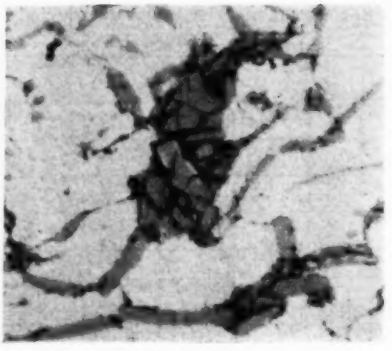


A X 100 DIA.

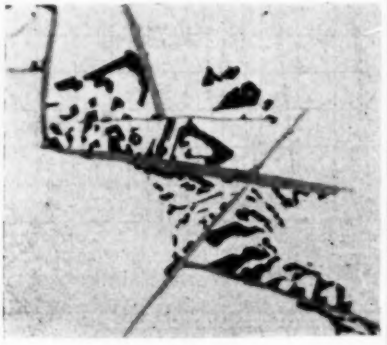
A X 100 DIA.



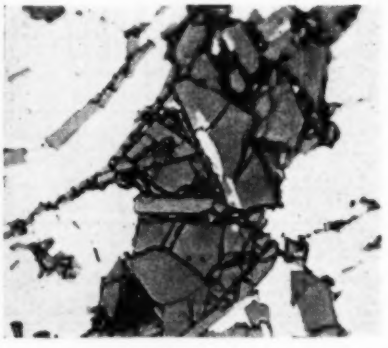
B X 500 DIA.



B X 500 DIA.



C X 1000 DIA.



C X 1000 DIA.

FIG. 8—AVERAGE STRUCTURE FIG. 9—SEGREGATED AREA ADJACENT TO PIPE—BOTH FIGURES REPRESENT ALUMINUM INGOT CONTAINING, SILICON, 0.99; IRON, 0.51; AND COPPER, 0.32 PER CENT AS IMPURITIES—UNETCHED

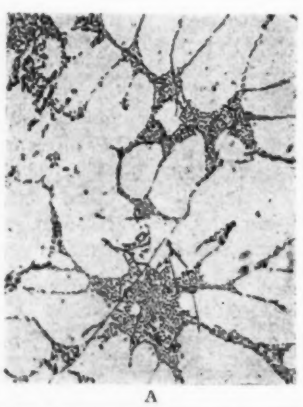
copper-silicon-aluminum alloys will hold their strength with only a slight decrease up to 300 degrees Fahr. and the strength at 600 degrees Fahr. is about that obtained from the higher copper alloys, say 10 to 12 per cent.

The most interesting feature of the whole series is that only one bar cracked in the hot-shortness test. This was from the melt containing 6 per cent of copper and 9 per cent of silicon. All of the others withstood this test without sign of cracking. They were then pulled in the ordinary way and showed a tensile strength slightly higher than the average for their melt, and an elongation slightly less. This is considered quite remarkable, inasmuch as a number of other aluminum alloys have been subjected to the same test and all have cracked in the mold. This cannot be explained on the grounds of low shrinkage or of low coefficient of expansion, as the curves show these properties do not differ greatly from the more common aluminum alloys.

It should be emphasized that the results of this investigation were obtained without the use of any flux or the introduction of alkali metals, by a simple mixing of metals according to well established foundry practice which may be carried out with ease in any small foundry. An alloy may be thus made having physical properties equal or superior to No. 12 alloy* and having much better casting qualities than any aluminum alloy with which we have had experience.

In Fig. 8 *a* shows the average structure of a specimen of the aluminum ingot used in this investigation. The impurities, silicon and iron, form a network structure. Fig. 9 *a* shows a segregated area adjacent to a pipe near the center of the specimen. A comparison of this with Fig. 8 *a* gives an indication of the extreme care which should be exercised in taking a chemical sample. Figs. 8

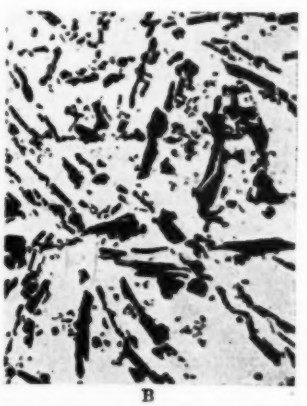
*Composition: Copper, 8 per cent; aluminum, 92 per cent.



A

B

A



B

FIG. 10—ALUMINUM WITH 3 PER CENT ADDED SILICON—LEFT, X 100 DIA.; RIGHT, X 500 DIA. FIG. 11—ALUMINUM WITH 6 PER CENT ADDED SILICON—LEFT, X 100 DIA.; RIGHT, X 500 DIA.—ALL UNETCHED

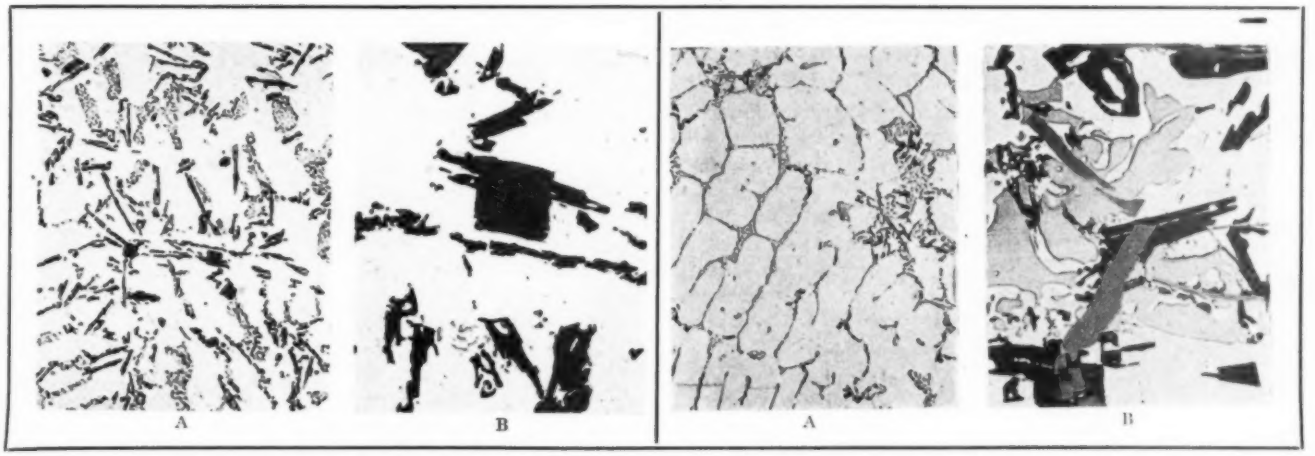


FIG. 12—ALUMINUM WITH 9 PER CENT ADDED SILICON—LEFT, X 100 DIA.; RIGHT, X 500 DIA. FIG. 13—ALUMINUM CONTAINING 3 PER CENT SILICON WITH 4 PER CENT ADDED COPPER—LEFT, X 100 DIA.; RIGHT, X 500 DIA.—ALL UNETCHED

b and *c* are of the same area as Fig. 8 *a* at 500 and 1000 diameters respectively. The fine eutectic appears blue-gray in color in the unetched specimen, and has been definitely identified as the silicon-aluminum eutectic. The needles appear a light gray in the unetched specimen and are characteristic of what has been described as $FeAl_3$ in both form and color. The copper present is in solid solution. Figs. 9 *b* and *c* are of the same area as Fig. 9 *a* but taken at 500 and 1000 diameters. The irregular masses and strings which show gray in these figures are the same color as the needles shown in Figs. 8 *b* and *c*. It is thought that this may be the constituent that is described by Merica* and the eleventh report of the alloys research committee of the British Institute Mechanical Engineers as constituent *X*. It may be observed that the segregate consists mostly of this constituent.

The effect on the microstructure of increasing the amounts of added silicon is shown in Figs. 10, 11 and 12. Fig. 10 *a* with silicon 3 per cent, shows the average structure at 100 diameters and *b* shows the average structure with 6 per cent added silicon and *b* shows at 500 diameters some of the silicon-aluminum eutectic appearing in a coarser form.

Chemical Analyses

Added percentages			Analysis, per cent			
Copper	Silicon	Manganese	Copper	Silicon	Iron	Manganese
0	0	0	0.32	0.99	0.51	Nil
0	3	0	0.41	4.12	0.59	"
0	6	0	0.42	6.20	0.90	"
0	9	0	0.34	9.34	0.73	"
2	3	0	2.15	2.66	0.62	"
2	6	0	2.32	6.69	0.65	"
2	9	0	2.29	9.58	0.71	"
4	3	0	4.25	3.41	0.74	"
4	6	0	4.17	4.92	0.72	"
4	9	0	4.26	10.12	0.70	"
6	3	0	6.39	3.90	0.77	"
6	6	0	6.39	6.28	0.51	"
6	9	0	6.29	9.00	0.66	"
2	3	1	2.33	3.86	0.65	0.87
2	6	1	2.40	9.97	0.63	0.67
2	9	1	2.20	9.56	0.97	0.71

* P. D. Merica, R. G. Waltenberg and J. R. Freeman Jr., "Constitution and Metallography of Aluminum and Its Light Alloys with Copper and Magnesium," *Scientific Paper* No. 337, United States bureau of standards, 1919.

the blue-gray silicon-aluminum eutectic and needles of the iron constituent at 500 diameters magnification. Fig. 11 *a* This appears somewhat darker than the fine eutectic in *a*, but under higher magnification it has the same coloring. Fig.

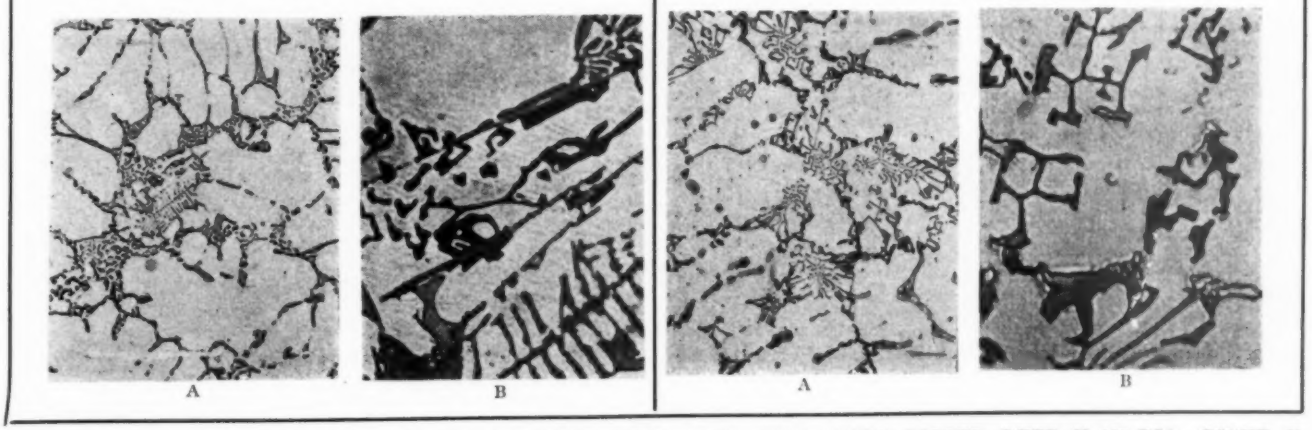


FIG. 14—ALUMINUM CONTAINING 3 PER CENT SILICON WITH 6 PER CENT ADDED COPPER—LEFT, X 100 DIA.; RIGHT, X 500 DIA. FIG. 15—ALUMINUM CONTAINING 3 PER CENT SILICON WITH 2 PER CENT COPPER AND 1 PER CENT MANGANESE—LEFT, X 100; RIGHT, X 500—ALL UNETCHED

12 shows the effect of 9 per cent added silicon. In addition to the silicon-aluminum eutectic and iron constituent, there is a third constituent which appears a bluish gray of a somewhat different shade from the silicon eutectic and usually appears in cubes such as are shown in Fig. 12 *b*. This constituent has been observed in practically all the specimens of this series examined, but is more plentiful in the melts containing 9 per cent of added silicon. This constituent may be primary silicon or it may be due to some impurity in the silicon-rich hardener used.

Figs. 13 and 14, shows the effect of copper on the microstructure of the 3 per cent silicon alloy. Fig. 13 shows in addition to the dark silicon-aluminum eutectic, a lighter eutectic globular in form which appears bright with a faint pink tinge in the unetched specimen, and is colored brown by Hanson's HNO_3 quench, both of which identify it as $CuAl_2$. The needles and the peculiar skeleton structure in Fig. 14 are identical in color and are not attacked by hydrofluoric acid or either 5 or 20 per cent solutions of hot nitric acid, or by a 0.1 per cent solution of sodium hydroxide. According to Hanson, the $FeAl_3$ may be identified by nitric acid or hydrofluoric acid, but results were all negative in this investigation.

In Fig. 15, a constituent appears in half tone which cannot be distinguished in color from what has been referred to as constituent *X*. However, the particular form in which it occurs has only been observed where manganese in addition to the use of a 5 per cent solution of hot copper and silicon are used as added elements in this series. Fig. 15 *b* shows the characteristic swastika form.

How and Why in Brass Founding

By Charles Vickers

Lead Castings for Pumps

Please advise a formula for making lead castings for water pumps to withstand acid. We have tried antimony, but it leaves the castings too brittle, and the threads chip off.

It is possible that an alloy of lead 90 per cent, tin 5 per cent, and nickel, 5 per cent would be satisfactory. The hardness of the alloy can be increased by increasing the nickel. However, antimony is the logical hardening element for lead, and any degree of hardness desirable within the possibilities of such alloys can be obtained by varying the percentage of antimony. In regard to this matter we are unable to advise because the percentage of antimony that has been experimented with has not been given.

Trouble from Cold Metal

We have had some trouble in the form of leakage of brass nuts and are sending for your inspection two castings which we have broken to show the fracture of the alloy. The smaller of the two samples split when tested, which we think due to a crack while hot, but the machinists contend it is a cold shut. The larger casting leaks, and the cause of this is unknown as care is used in molding and no water is allowed on the molds.

The split in the case of the small casting is caused by an inclusion of oxide at that point which has acted the same as parting on a mold surface. Green oxide, is not formed in the metal during the melting period, but is formed while pouring; it is part of the film that forms around the stream of metal as it falls from the crucible lip. It is due to cold pouring, and we suggest that you employ considerably hotter metal to pour your castings in future. In pouring castings of this character it always is better to err on the side of a little too much heat than not enough.

The large casting also will be benefited by hotter pouring but the appearance of the fractured surfaces would seem to indicate that something has been added to the alloy that prevents homogeneity by causing a localized selective alloying of the different metals comprising the alloy. In a red metal containing relatively large amounts of lead and zinc with little tin, this change is caused by the addition of too large a percentage of a deoxidizer like phosphorus. The mixture itself may be at fault as the metals mentioned do not alloy in all proportions to produce a homogeneous metal. There is the possibility of oxides causing the mixed fracture. Therefore, to properly diagnose the trouble, the analysis of the alloy, the manner in which it was made, and the deoxidizer used should have been given, also it should be stated if it was melted in crucibles, or noncrucible furnaces, and if in the latter, was it *poled?*

Strength Is Secondary To Conductivity

We are making brass castings for seam welders and would like to know the best mixture for the casting carrying the secondary current. We would like to use the elements giving us the best conductivity and at the same time ensuring a fair strength. The castings are quite heavy and we do not believe the feature of strength is of prime importance.

Copper has the highest conductivity, but whether an electrical copper or a mechanical copper casting is required will depend upon the cross sectional area of the casting. Thus if the casting is much heavier than necessary to carry the current it will make little difference whether copper or red brass is used. The choice will depend on the physical properties demanded of the metal. If a certain amount of strength and toughness is wanted, then an alloy of copper 90 per cent, tin 6.5 per cent, lead 1.5 per cent, and zinc 2 per cent will be satisfactory. A very good casting mechanical copper will have slightly higher electrical conductivity. An alloy of copper 92 per cent, 70-30 yellow brass clippings 7 per cent, and 5-per cent phosphor tin 1 per cent will be in order.

A pure copper casting also can be made. The electrical conductivity could be guaranteed not under 85 per cent, but unless absolutely necessary to have such pure material, the mechanical copper mitxure outlined will be better as it may be cast easily.

Pattern Metal Alloy

We require a formula for a nonshrinkable metal for casting metal patterns and pattern plates direct from the original patterns. We know of a mixture containing 100 *pounds lead,* 20 *pounds zinc and 20 pounds tin, but would like to get a better one.*

If the alloy mentioned is nonshrinkable, we know of nothing better and cheaper. However, we believe that an alloy of zinc 50 per cent and tin 50 per cent would be harder and might stand harder use with less damage. Also, it is not so heavy as a leadbase alloy such as the one mentioned. The 50-50 alloy has the advantage of being easily used up when the patterns are retired, for a half tin, half zinc alloy can be added to copper in making most of the red brass used in brass foundries.

Survey Made of Foundry Industry

By R. E. Wendt

Next to the labor problem, one of the most serious problems confronting the foundryman today is the unfair competition in bidding on contract work. It seems that many foundrymen have no system for bidding on work, nor do they have any system of keeping cost and, therefore, do not know what it costs to make their castings. It is encouraging to know, however, that some of our foundrymen are developing cost keeping systems and know what it costs to make their castings.

When the different foundrymen bid on jobs one would hardly believe that there could be such a difference in the estimated price of producing castings as is shown. To illustrate, I was told of many instances that the bids ran from 3 to 12 cents a pound on the same lot of castings. This seems to indicate that some one was badly mistaken in the bidding, because there is not that much difference between foundry operations. Buyers of castings know that there is no uniform method of bidding on work in gray-iron foundries. These buyers also know the foundries who make castings at a loss, and generally such foundries will get the job and other foundries to get the work must compete with them. There seems to be great need for education along the line of costs and it is a problem that must be solved.

In summing up the conditions in our foundries I find many problems to be solved. The three main problems are the labor problem, the training of young men in foundry work, and the training of the foundrymen of today to co-operate with one another to develop better foundry conditions.

To solve these three problems will require the co-operation of all foundrymen. The labor problem can be solved, by making the conditions more attractive to labor.

The training of young men may be done in commercial shops or schools, by making the inducements greater, encouraging young men to take up the practice and study of foundry work, and showing them that the chances for advancement in the foundries are good for men that are willing to work hard.

The training of foundrymen that are in the business today only can be done by showing them that the old saying, "united we stand and divided we fall" is true.

We at the university have often wondered how much the technical schools are doing in the training of young men along the foundry lines. Foundrymen also have asked us the question, what are the schools doing for the foundry business? We have looked about for information on the subject but are unable to find much. A questionnaire was sent out to 70 technical schools for information. From the data received it was found that the technical schools were not doing a great amount in the line of training foundrymen because the time spent on foundry work is far too short to make practical foundrymen such as the business needs. I believe that if more of the foundrymen would co-operate with the men teaching foundry work, much better results could be obtained.

Abstract of a paper presented before a recent conference of Indiana foundrymen, held recently at Purdue university, Lafayette, Ind. The author is instructor of the foundry course at Purdue university.

Small Cupola Produces Hot Iron

Question: We make both heavy and light castings and recently we have experienced considerable trouble with shrinkage. We have checked over our cupola practice and find that the iron is too hot and also that it is melted at a speed greatly in excess of the rated capacity of the cupola. The cupola has a 42-inch shell lined down to 30 inches and is provided with four tuyeres 4 inches square at the back and flared to 4 x 12 inches on the inside. We want to place the stack on a basis where it will melt about 2½ tons per hour and and will appreciate your advice on the height of fuel bed, relative weight of charges and blast pressure to bring about that result. Will you kindly recommend a book on the subject of cupola operation. We have a considerable amount of published data on hand but it refers principally to large cupolas and we are doubtful if the information can be adapted to fit our comparatively small melting medium.

Answer: Your trouble is rather unique in that the principal problem of the average foundryman is to melt his iron at a higher temperature. We are inclined to the opinion that some other factor than high temperature is responsible for the iron shrinking in your castings. You do not state what amount of iron you are melting under present conditions, but if it is not over 3½ tons per hour, it is not in excess of the cupola capacity. A cupola operated under favorable conditions will melt at the rate of 10 pounds per hour for every square inch of horizontal area at the melting zone. In your case that means 7200 pounds. We do not recommend melting at a slower speed or a lower temperature as a remedy for your shrinkage trouble. However, if for any other reason it is necessary to reduce the melting speed to 2½ tons per hour, the blower's speed should be reduced.

The Foundryman's Hand Book; Principles of Iron Founding, by Moldenke, and *American Foundry Practice*, by West all may be secured from the Penton Publishing Co., Cleveland and will supply you with all necessary information on the subject of cupola operation. In fact they cover practically every phase of foundry practice. The maker of your cupola has published a certain amount of literature on cupola melting practice and gladly will send you a copy on request.

Editors Meet in Ohio City

The National Conference of Business Paper editors was entertained by the chamber of commerce of Middletown, O., March 26 and 27. Bennett Chapple, director of publicity, the American Rolling Mill Co. was in charge of the local arrangements. Inspection trips were made to the open hearths, sheet mills and foundries of the American company and to the paper mills of the city.

Due to the illness of President H. C. Parmelee, of *Chemical and Metallurgical Engineering*, George Smart, one of the editors of *Iron Age* acted as chairman of the business sessions.

L. T. Palmer president of the Middletown chamber of commerce presided at the banquet held Monday, March 26. The recreational and community interests of the city were set forth by various speakers. Fred M. Feiker who recently has been appointed by Secretary Hoover to establish an organization to investigate rubber, sisal and other raw products, with a view to the possible need of producing these commodities in our country, responded on behalf of the visiting editors.

Large Aluminum Imports from Norway

Among the $12,000,000 worth of declared exports from Christiania, Norway, to the United States in 1922, as reported to the commerce department by Vice Consul H. E. Carlson, was 8,645,076 pounds of crude aluminum, valued at $1,442,313. Other important metal exports from this port to the United States included 436,766 pounds of zinc, of a value of $30,628.

Incorporates Brass Shop

The B. J. Ripley Brass Foundry recently was incorporated by B. J. Ripley, A. M. Ripely, and E. L. Bishop. B. J. Ripley is president, and A. M. Ripley is treasurer. The company which is capitalized at $10,000 has taken over the J. B. Ripley foundry and will manufacture nonferrous castings.

THE FOUNDRY

Reg'stered U. S. Patent Office

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI.....504 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND.2-3 Caxton House, Westminster, S.W. 1
PARIS, FRANCE.....23 Rue de la Bienfaisance VIIIe
Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents
Copies published three months or more previous to date of current issue, 50 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 1st and 15th of the month preceding date of publication.

Member, the Audit Bureau of Circulations, Associated Business Papers, Inc., and National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1923 by The Penton Publishing Co.

Contents

	Page
Foundry Operates Efficiently	289
Brick Lining Burns Away at Melting Zone	297
Cleveland Prepares Third Reception for Foundrymen	298
City Is Versatile	308
Exhibits Will Fill Entire Auditorium	310
Green Sand Core Arbors	317
Pattern Finish Allowance	317
Bill Has a Word on Cupola Practice—I	318
Controlling Cast Iron Hardness	321
Book Review	322
To Rebuild Facing Mill	322
Operating Wilson Foundry—III	323
Molds a Track Curve Without Pattern	327
Oxyacetylene Torch Cuts Iron	328
Engineers Move Offices	330
Copper-Silicon-Aluminum Alloys	331
How and Why in Brass Founding	336
Trouble from Cold Metal	336
Strength Is Secondary to Conductivity	336
Pattern Metal Alloy	336
Survey Made of Foundry Industry	337
Small Cupola Produces Hot Iron	337
Editors Meet in Ohio City	337
Large Aluminum Imports from Norway	337
Incorporates Brass Shop	337
Do Technical Associations Pay?	338
Personal	340
Quad City Association Nominates	340
Electricity in Foundry Is Discussed	341
To Visit International Foundry Exhibit	341
Obituary	341
Consolidates Offices	341
New England Foundrymen Hold Meeting	341
Set Date for British Foundry Sessions	342
Designs Filing Machine for Metal Saws	342
Lifting Magnet Presents New Features	342
Preheater Burner Is Easy to Make	342
Investigate Corrosion of Metals in Mine Water	342
Strong Demand Continues	343
What the Foundries Are Doing	344

Do Technical Associations Pay?

DOUBTLESS if the first Briton who poured a bit of casually melted natural bronze into his stone mold to make a spear head had lacked all contact with his fellow man, some other more social being much later might have learned to duplicate the process. However, if these conditions had obtained the science of casting metals still would be in an elementary state. Practically all development along technical lines can be traced directly to contact between minds, an interchange of ideas and a community of business interest. No real progress ever is made by one who like Kipling's cat, "walks alone and knows no man." Only by adopting ideas from others, and in turn communicating our own, can we expect to advance along the road that leads to perfection.

This principle is fundamental. Its truth is attested by the record of progress credited to the great technical organizations which, after all, owe their real growth to the fact that man selfishly can advance himself through the aid of others.

The American Foundrymen's association primarily was established to bring foundrymen together to discuss problems most vital to their common interest. The association has grown over a period of 27 years and steadily has reshaped its collective thought to meet the needs of the industry. From the first, the main purpose of the organization has been to serve. The science of casting metals as represented by American foundry practice has grown from the roots planted in the subsoil by such men as West, Keep, Seaman, Schuman, Moldenke and others.

The idea of bringing together manufacturers of foundry equipment and supplies at the annual meetings of the association, was adopted through the wisdom of those who recognized the benefit that would accrue to the foundryman himself. True, an exceptional advertising opportunity is offered to those same manufacturers to display their products to the best possible advantage. However, the real beneficiary from the plan has been and will continue to be the practical castings manufacturer. In a short period of time he can look over and compare all the various kinds of machinery and supplies offered. His foremen come into intimate contact with equipment representatives and compare notes with others who use similar products, or equipment, and the net result is his shop will attain the highest efficiency and the greatest economy in the equipment operated.

The American Foundrymen's association does not seek to eliminate or to limit competition in the industry. It does not enter into the business phases of castings manufacture; but it does direct attention to the problems of manufacure and more recently has concerned itself more largely with the questions of employment relations, cost finding and better business practice which in the end assure a more healthy condition throughout the entire industry. Undoubtedly, as a result of its work the general financial condition of foundrymen has shown a decided improvement during the past few years. More yet remains to be done, but the work clearly is under way, a wider responsibility has been assumed and the entire foundry world cannot fail to profit by the fruits of its labors.

The work handled by the association, that is work which it can legitimately undertake, is limited by the number of active members. The membership is not as great as it should be considering that the benefits accrue to members and nonmembers alike.

Trade Outlook in the Foundry Industry

INDUSTRIAL activity continues to grow until in many lines unprecedented production is resulting. The pig iron output for March was the largest in the country's history. Automobile manufacture continues at top speed, and the past month surpassed any previous March figure recorded in the total number of passenger cars and trucks made. Building construction was away early in the year on what promises to be the most extensive program ever undertaken. With all the resulting business which leading economicts predict will continue at least to the third quarter, the foundry industry is well along on a most prosperous year.

Labor Worry Grows

With the pickup in all industries simultaneously, the available supply of labor quickly has been absorbed. Competition entered early in the year and a steady advance in wages is reported. The U. S. Steel Corp. on April 9 advanced its wages all along the line by 11 per cent, bringing common labor in the Youngstown plant of its subsidiary where the raise first was announced from 36 to 40 cents an hour. The gradual advance in many instances has brought a heavy turnover, men leaving one place of employment to drift along to another plant where higher wages are paid. This is true particularly where the competition offered by the busy automobile factories is keen. In Detroit, thousands of workmen are coming to the employment gates every morning, drawn by the high prices paid for men. On April 9, the Detroit Employers' association reported a total employment of 222,450 men during the preceding week, the number constituting a new high record for the city. Foundries are suffering severely in some sections. The lure of light machine work, coupled with high wages, in some cases exaggerated through rumor, is taking men away from the castings establishments every day. In the smaller towns, outdoor work offered in constructional and agricultural lines depletes the foundry ranks.

Prices of Raw Material for Foundry Use

CORRECTED TO APRIL 9.

Iron		Scrap	
No. 2 Foundry, Valley	$31.00 to 32.00	Heavy melting steel, Valley	$27.00
No. 2 Southern, Birmingham	27.00	Heavy melting steel, Pitts.	25.50 to 26.00
No. 2 Foundry, Chicago	32.00 to 33.00	Heavy melting steel, Chicago	22.50 to 23.00
No. 2 Foundry, Philadelphia	31.76 to 32.13	Stove plate, Chicago	24.50 to 25.00
No. 2 Foundry, Buffalo	29.50 to 31.00	No. 1 cast, Chicago	29.75 to 30.25
Basic, Valley	31.00	No. 1 cast, Philadelphia	27.00 to 28.00
Basic, Buffalo	29.50 to 30.00	No. 1 cast, Birmingham	23.00 to 24.00
Malleable, Chicago	32.00 to 33.00	No. 1 cast, Buffalo	27.50 to 28.50
Malleable, Buffalo	30.00 to 30.50	Car wheels, iron, Pittsburgh	27.50 to 28.00
Coke		Car wheels, iron, Chicago	28.00 to 28.50
Connellsville foundry, coke	$8.00 to 8.75	Railroad malleable, Chicago	29.00 to 29.50
Wise county foundry, coke	8.50 to 9.50	Agricultural mal., Chicago	27.50 to 28.00
		Malleable, Buffalo	27.50 to 28.50

Railroad Problems

With the tremendous strides of of business, the volume of freight traffic is increasing daily. It is believed that the inability of the railroads to move raw materials to the factories and to distribute the products soon will have a serious effect. Already shipments have slowed, and tracers are making their appearance at foundries, particularly those making automotive castings, to follow orders through the shops and to stay with them during shipment until their final delivery at the customer's factory. The railways are endeavoring to meet this crisis, and continue to place large orders for equipment, but the shops making cars and locomotives are crammed and little hope is held for quick relief from this source. A concerted effort is urged to secure full loading for all cars shipped. It is stated that only about half the capacity of a car constitutes the average present loading. Increasing the amount placed in each car by one ton, according to the statement of railway authorities, will be equivalent to adding 100,000 cars to the number in service. Railroads are purchasing machine tools in larger quantities and thus serving to bring more orders for castings to foundries supplying the machine tool trade.

Iron Output Greatest

Indicative of the general condition is the tremendous production of pig iron during March. According to statistics compiled by *Iron Trade Review*, the past month excelled all previous records with its total tonnage of 3,521,902 gross tons of pig iron. The previous high mark was established in October, 1916, when 3,508,180 tons was made. On a daily basis, the average output for last month was 113,610 tons per day, ranking second only to the daily average record for September, 1918, when an average of 113,774 tons established the high figure. However, the March daily average was at the rate of 7001 tons per day ahead of the daily average rate for the year 1916 when the highest total for any year was established. The high total marked by March, 1923, is the more remarkable when one considers the number of furnaces in blast. On the last day of the past month, 296 furnaces were active, while in September, 1918, 364 furnaces were in blast. March gained over February by a difference of 527,984 tons, comparing the respective totals. In March the production of merchant pig iron reached 776,144 tons, which compared with the February output of 708,901 tons gives a gain of 67,243 tons.

Brass Shops Prosperous

Constructional and automotive demand continue to furnish a heavy demand for nonferrous castings. Aluminum foundries, particularly those making sweeper and other domestic utility castings are busy. Prices for nonferrous metals, based on New York quotations in the *Daily Metal Trade* of April 9 follow: Casting copper, 16.87½c; electrolytic copper, 17.25c; straits tin, 46.62½c; lead, 8.50c; antimony, 8.75c; aluminum, No. 12 alloy, open market, 24.50c to 25.00c. Zinc is 7.40c, E. St. Louis, Ill. Monthly average prices for March follow:

(New York Quotations)

Casting Copper	Electrolytic Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
16.681	17.133	8.417	48.551	8.700	25.409	7.877

Personal

George Satterthwaite has resigned as vice president of the Penn Seaboard Steel Corp. and the Tacony Steel Co., Philadelphia, to become associated with Henry Disston & Sons, Inc., of the same city. Mr. Satterthwaite has had a wide experience in the production of high grade steels. He was for a number of years connected with the original Midvale Steel Co., and the Midvale Steel & Ordinance Co. As general superintendent of the Nicetown works, Mr. Satterthwaite was in direct charge of all manufacture, including the production of Midvale's numerous alloy steels and ordnance material for American and foreign governments. In 1917 Mr. Satterthwaite resigned as general superintendent of the Nicetown plant to become vice president and general manager of the Tacony Ordnance Corp. Later the Tacony Ordnance Corp. consolidated with the Tacony Steel Co., Mr. Satterthwaite continuing as vice president of the combined companies. In 1919 the Tacony company joined with the Penn Seaboard Steel Corp. and Mr. Satterthwaite was elected to the position he has just vacated, vice president in charge of operations at the Penn Seaboard-Tacony plants, in Tacony, Philadelphia, New Castle, Delaware, and Chester. Mr. Satterthwaite will continue as a director of both Penn Seaboard Steel Corp. and the Tacony Steel Co. He is a graduate of Swarthmore college and a resident of Huntington Valley, Pa.

Samuel Mather, senior member of Pickands, Mather & Co. ,Cleveland, has been elected a director of the Bankers Trust Co., New York, to fill the vacancy caused through the death of Nicholas Biddle.

John R. Poyser, for the past 12 years secretary of the Canton Foundry & Machine Co., Canton, O., recently resigned that position to become sales manager of Doelger & Kirsten, Milwaukee, manufacturer of steel shears.

Ralph W. Clark, manager of the New York pig iron department of Pilling & Co., 120 Broadway, has sailed for a short business visit in England.

Stewart C. Wilson, formerly Pittsburgh representative of the Whiting Corp., Harvey, Ill., now is connected with the Hockensmith Wheel & Mine Car Co., Penn Station, Pa.

H. M. Dudley has been appointed Pacific coast representative for the McWane Cast Iron Pipe Co., Birmingham, Ala. His headquarters are at 1007 Central building, Los Angeles.

Emile Ramas, president of the Association Technique de Fonderie de France, will visit the United States in April to attend the annual meeting of the American Foundrymen's association at Cleveland. The purpose of Mr. Ramas' trip is to invite American Foundrymen to the international foundrymen's congress in Paris in September. Mr. Ramas will arrive in New York, April 21, where he will be met by a committee representing the American Foundrymen's association. From New York he will go direct to Chicago. Here he will be the guest of the Association of Manufacturers of Chilled Car Wheels until the opening of the convention of the American Foundrymen's association, April 28. Mr. Ramas is director of the Societe Francaise Metallurgique (Procedes Griffin), 2 Rue de Constantinople, Place de l'Europe.

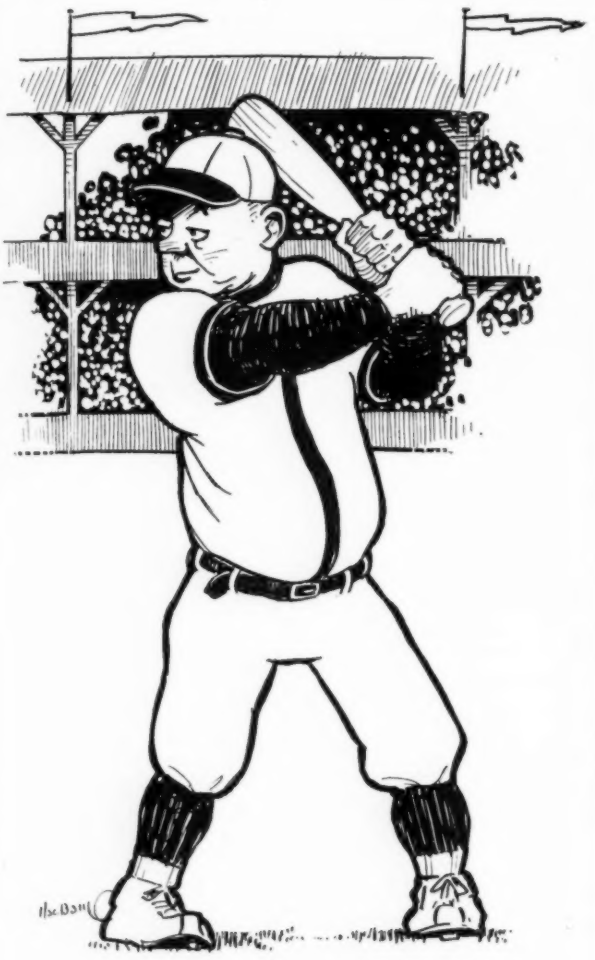
E. Donald Jerome has been appointed to the pig iron sales department of Crocker Bros., in the New York territory. Mr. Jerome for six years was with the pig iron selling department of the Bethlehem Steel Co. and more recently New England representative of the Pulaski Iron Co.

E. V. Coulston, who has been connected with the Rock Island Stove Co., Rock Island, Ill., for 12 years as secretary and sales director, has become general manager of the Ideal Bronze Co., Cleveland. He has been active in the stove and furnace business in the Middle West for the past 20 years.

Frank H. Grace, formerly vice president and sales manager of the Werner G. Smith Co., Cleveland, now is a member of the firm of Grace, Hunter & Mitchell, Cleveland, direct mill representative. Associated with him is Daniel S. Hunter, who is secretary of the Steel Barrel and Fire Extinguisher association, and Frank A. Mitchell, formerly production manager of the Lakewood Engineering Co., Cleveland, and prior to that purchasing agent for the same company. He is a member of the National and the Cleveland Associations of Purchasing Agents.

Fred W. Moore, president and treasurer of the Millbury Steel Foundry Co., Millbury, Mass., has resigned as agent of the Cordis Mills in that town, a position he has held for 32 years.

FAKED FOUNDRY FACTS



TAP 'ER OUT

Quad City Association Nominates

Enrique Touceda, Albany, N. Y., consulting engineer, the American Malleable Castings association addressed a joint meeting of the Quad City Foundrymen's association and the local section of the American Society for Steel Treating, held at Davenport, Iowa, March 15. The fact was brought out that about 1,250,000 million tons of malleable cast

iron are produced annually in this country, and most of it is used for automotive parts. The nominating committee of the Foundrymen's association nominated for president A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; vice president, John Ploehn, French & Hect, Davenport, Iowa; secretary and treasurer, H. C. Cooper, John Deere Harvester Works, East Moline, Ill. The following were nominated as directors: A. K. Reading, Zimmerman Steel Co.; H. Soverhill, Davenport Locomotive Co.; Leon Mitchell, Rock Island Stove Co.; Martin Carlson, Barnard & Leas; and P. T. Bancroft, John Deere Harvester Works.

The next meeting of the Quad City Foundrymen's association to be held at the Moline chamber of commerce will be addressed by Herman Heidbreder, president of the Central Pattern Works, Quincy, Ill., and George P. Pearce, foundry engineer, Union Malleable Iron Works, East Moline, Ill. Both papers will deal with the problems of the pattern shop as related to the foundry.

Electricity in Foundry Is Discussed

Frank W. Brooke in discussing "Electricity in the Foundry" before 100 members and guests of the Pittburgh Foundrymen's association, Monday evening, March 19, fully described electric furnace practice as applied to foundry needs. The occasion was the March meeting and dinner of the organization held at the General Forbes hotel, and its president, S. B. Cuthbert, presided. Mr. Brooke, who is chief engineer of William Swindeli & Bros., Pittsburgh, has talked before local foundrymen's organizations at Philadelphia, Chicago, Cincinnati and Detroit.

Plans are being formulated for the attedance of a large number of Pittsburgh foundrymen at the annual convention of the American Foundrymen's association and exhibition at Cleveland, April 30 to May 3.

Obituary

Samuel H. Jacobs, for a long time vice president and general sales manager of the Fanner Mfg. Co., Cleveland, died recently at his home in Cleveland. Mr. Jacobs has a wide acquaintance among stove manufacturers in the United States and the larger part of Canada, with whom his business relations brought him in contact.

James McGee, who was connected with the Dempsey Brass Foundry, Lynn, Mass., died March 10.

George Walbridge Miller, formerly head of the Buffalo Car Mfg. Co., and Niagara Car Wheel Co., Buffalo, died at New York March 12. He was 82 years old.

Charles J. Mesta, aged 50, sales manager of the Mesta Machine Co., West Homestead, Pa., died March 6 as a result of a bullet wound, self-inflicted. He was found dead in his office, 1244 Oliver building, Pittsburgh, the evening of that day by his brother Fred E. Mesta, vice president of the company, and a brother-in-law W. J. Hirth, neither of whom could ascribe a reason for the act. Mr. Mesta formerly was second vice president of the Mesta Machine Co. He was elected to the state house of representatives in 1906 and served one term. He fathered the bill which resulted in the organization of the Pennsylvania state constabulary at that time. Formerly he was associated with the engineering department of the Leechburg Foundry & Machine Co., Leechburg, Pa., of which he later became superintendent. Mr. Mesta was born in Bethel township, Allegheny county, was educated in the public schools and later graduated from the University of Pittsburgh.

SAMUEL H. JACOBS

Edward H. Dean, president of the Dean Bros. Steam Pump Works, Indianapolis, died March 11 at his home from kidney trouble. Although he was 83 years old, his death was unexpected as he appeared to be enjoying excellent health a few hours before he was stricken. He was born in Deansboro, N. Y., in 1843, but later his family moved to New York City. He attended the public schools in Brooklyn, and later learned the machinists' trade. During the Civil War he served in the navy as an engineer. Following the close of the war Mr. Dean entered the foundry and machine business at Rome, N. Y. In 1870 the business was removed to Indianapolis, and for more than 30 years he has been president of the company.

Charles A. Maher, aged 51 years, widely known car wheel manufacturer, died in Cleveland, April 8., after an illness of several months. Following his graduation from Georgetown university, he became associated with his father, Thomas Maher, in the Maher Wheel & Foundry Co. When the concern was merged into the National Car Wheel Co. in 1903, he was electel first vice president.

Book Review

A Tested Method of Laboratory Organization, by Seymour Pile, M. A. and Reginald Johnston, cloth, 98 pages, 5 x 7¼ inches, published by H. F. and G. Witherby, London, England, and furnished by THE FOUNDRY, Cleveland, for $3 net.

Experience secured in the organization and operation of a large co-operative laboratory serving the many small foundries in the district around Birmingham, England, has been drawn upon by the authors in compiling a book for the guidance of those establishing or operating a laboratory where a variety of work is received. Starting with the question of buildings and the arrangement of tables and equipment, the authors deal with every aspect of organization—personnel, instruments, records, costing, etc. The selection and training of a scientific staff is fully discussed. The cost system described has successfully stood the practical test of actual working conditions and enables the determination of the cost of the various work done in the laboratory.

Consolidates Offices

District and local offices of the Sprague Electric Works of the General Electric Co. have been consolidated with corresponding offices of the parent company. The manufacture and exploitation of Sprague products will be continued in the name of the General Electric Co. in the recently organized merchandise department.

New England Foundrymen Hold Meeting

Medical activities in industry formed the topic of discussion at the regular monthly meeting of the New England Foundrymen's association held March 15 at the Exchange club, Boston. Dr. F. E. Schubmehl of the General Electric Co., Lynn, Mass., gave some interesting information on

the importance of medical work in the foundry. The meeting was well attended and plans were discussed for a heavy representation at the annual convention of the American Foundrymen's association at Cleveland.

Set the Date for British Foundry Sessions

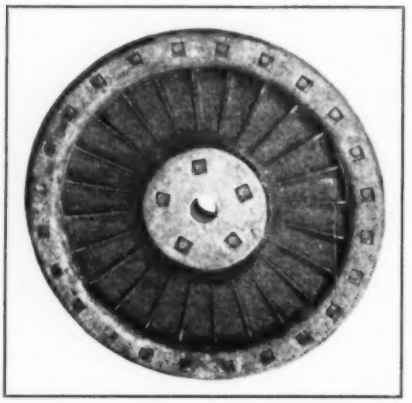
The annual convention of the Institution of British Foundrymen will be held in Manchester, England, June 13-15, according to present arrangements. A special program is being prepared for the entertainment of the visitors by the foundrymen of the Manchester district. A number of papers will be read and discussed including the exchange paper from the American Foundrymen's association. Officers will be elected for the ensuing year.

Designs Filing Machine for Metal Saws

A new filing machine especially designed to handle band saws used in cutting soft metal has been introduced recently by the American Saw Filing Machine Co., Boston. The accompanying illustration shows the machine with a section of the band saw in place being filed. The machine operates automatically, is belt driven and compact in arrangement taking little room. The device feeds the saw forward so that the file advances from tooth to tooth in the same manner as when hand filed. The position of the saw and file are positive during filing, and it is claimed the machine will correct for any irregularities in the teeth due to incorrect filing. One of the distinguished features of this machine is the method of feeding the saw. The feed is entirely independent of the teeth, preventing interruption when a broken tooth is encountered. The machine is adjustable to take saws from ⅛ up to 2 inches in width and the feed may be adjusted to file teeth as fine as 15 points.

Lifting Magnet Presents New Features

Engineers in the controller and magnet departments of the Cutler-Hammer Mfg. Co., Milwaukee, recently have added several features to the lifting magnet shown in the accompanying illustration. A heavy skirted outer pole shoe has changed the familiar appearance of the device to a considerable extent. The shoe is cast from a high permeability tough alloy steel and is fitted over the magnet body in such a manner that the shock of the



NEW LIFTING MAGNET

side blows on the pole shoe is transferred effectively to the heavier body used on the new magnet. Bolt heads on both the inner and outer pole shoes are sunk in protective pockets. The coils are wound with strap copper with asbestos ribbon insulation. Besides the changes in flanged pole shoe and body casting the new line of magnets is painted a distinctive orange red color adopted as standard.

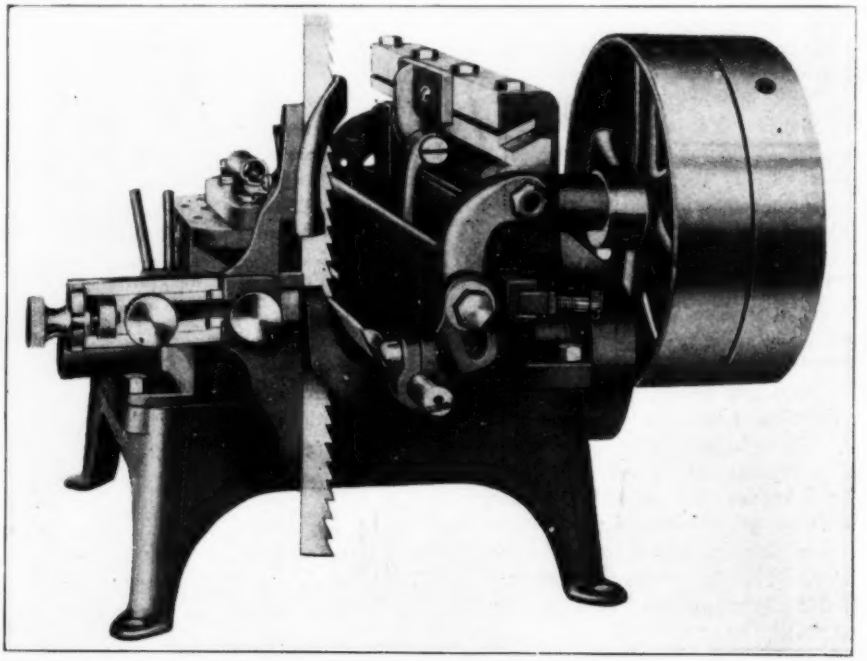
Preheater Burner Is Easy To Make

The Metal & Thermit Corp., New York, in conducting some recent extensive experiments with different types of burners to be used in connection with its standard thermit preheaters found that the best results were secured with a burner pipe ⅜-inch diameter, swaged down at one end and then drilled with a 5/16-inch hole. Such a burner pipe fully atomizes the fuel before it enters the mold and gives the best combustion. It was found that when larger burners were used, or when ends had not been swaged down, that considerable air and fuel is wasted. The fuel does not become fully atomized, with the result that raw oil is carried into the mold or is wasted by dripping from the end of the pipe.

Investigate Corrosion of Metals in Mine Water

That most of the alloys available for use in coal mine equipment are corroded extensively by the acid waters in mines was one of the results of tests described in Bulletin No. 4, published by Carnegie Institute of Technology, Pittsburgh. The corrosion tests on metals and alloys in acid mine water from coal mines were undertaken at the suggestion of an advisory board of coal operators.

According to the report, brasses, which contain considerable zinc were corroded rapidly; bronzes containing considerable tin were also corroded, but to a less extent than the brasses; cupro-nickel and nickel-silver alloys were corroded about to the same extent as the brasses. Alloys that were practically unattacked by the acid mine waters include a high chromium steel, two highly alloyed chromium-nickel-silicon steels, a nickel-chromium-iron alloy, and a high-silicon cast iron. These resistant materials possess certain disadvantages for general use in coal mine equipment, such as the brittleness and hardness of the high-silicon cast iron and the relatively high cost of the others.



AUTOMATIC BAND SAW FILING MACHINE DESIGNED FOR BELT DRIVE DIRECT FROM THE LINE SHAFTING

Strong Demand Continues

Foundry Equipment Sales Increase with the Volume of Castings Manufacturing Activity—Deferred Deliveries Have Appeared in Several Lines of Machinery

SALES of foundry equipment continue at a high rate and inquiries are correspondingly active. The Pekor Iron Works, Columbus, Ga., C. F. Pekor Jr., manager, is contemplating the purchase of extensive equipment and at present is interested in hand squeezers and pouring devices. A. N. Fitzgerald, Donna, Tex., is planning to build a foundry and desires information on all equipment and supplies, ranging from a cupola to molder's hand tools. A. R. Erskine, president of the Studebaker Corp., South Bend, Ind., has announced an expansion program requiring the expenditure of $5,000,000 including the foundry which has been under discussion for some time to cost 60 per cent of the amount mentioned. Recent sales by the W. W. Sly Mfg. Co., Cleveland, in the Ohio territory include sandblast equipment for the W. S. Tyler Co., Cleveland, and tumbling mills to the Lunkenheimer Co., Cincinnati, and M. Hertenstein Co., Columbus, O. Exports of sandblast machinery by various manufacturers have increased recently. The Northern Blower Co., Cleveland, has received contracts for dust collecting equipment from the Trumbull Mfg. Co., Warren, O., and the Ohio Steel Castings Co., Cleveland. Core ovens recently have been ordered by the Atlas Foundry Co. and the Cox Brass Co., Cleveland, from the same manufacturer.

Delivery Problem Arises in the East

AS TIME draws near for the annual convention and exhibit of the American Foundrymen's association in Cleveland, sales of foundry equipment are showing a slight tendency to slacken. Nevertheless, a heavy volume of business continues to be placed with equipment manufacturers falling behind on deliveries in some lines. This is particularly noticeable in conveying equipment and molding machines. While some sellers of cranes and hoists are still able to make fairly prompt delivery, they are in the majority of cases requesting six to eight weeks and in some instances considerably longer time. Molding machine manufacturers in some cases are working both day and night shifts and still are behind several weeks. While alterations and new plant projects are counting for a considerable amount of the present activity, the shortage of labor is an important factor, foundries buying considerable equipment to offset this scarcity. Recent buyers in this district are the New York Central, which has closed on a mixer and auxiliary equipment with the National Engineering Co., Chicago, for its Frankford, N. Y., shops; Pusey & Jones, Wilmington, Del., closing also on a mixer from the same maker, and the Brooklyn Foundry Co., Astoria, L. I., covering on a electric gyrating sifter. The Chapman Valve Mfg. Co., Indian Orchard, Mass.; the General Steel Casting & Machine Co., Newark, N. J., and the Berona Steel Castings Co., Berona, Pa., have also recently closed on mixers from the National Engineering Co. While no list has as yet been issued, equipment sellers are figuring tentatively with the Federal Signal Co., Albany, which contemplates the erection of a $50,000 foundry for the production of piston castings. The Electric Foundry & Engineering Co., Philadelphia, is inquiring for a 5-ton hoist, and the Reading Iron Co., Reading, Pa., is asking bids on a 10-ton electric crane with span of 60 and 80 feet for outside operation. The American Car & Foundry Co., New York, recently has closed on two 5-ton electric overhead cranes for an unnamed builder. This latter company also has been an active buyer of small foundry supplies. The Northern Blower Co., Cleveland, has received an order for a complete sandblast installation with turntables, dust collecting and conveying system from the American Radiator Co. The W. J. Loth Stove Co., Waynesboro, Va., has purchased four tumbling mills from the W. W. Sly Mfg. Co., Cleveland. Recent purchases of sandblast equipment in the East include the American Machine & Foundry Co., Brooklyn, N. Y., which has installed machinery made by the Mott Sand Blast Mfg. Co., Chicago, and the Bayonne Steel Castings Co., Bayonne, N. J., which has purchased an installation from the Pangborn Corp., Hagerstown, Md.

Lively Interest Features Chicago Market

BUYING of foundry equipment from Chicago makers is continuing at a rapid rate and demand for ladles and other small equipment indicates that the present melt of iron is unusually heavy. Orders for 30 to 60 ladles to a single foundry have been booked recently and carloads have been shipped to jobbers who find strong demand from smaller users. Foundry trucks and other equipment of this sort is also in much demand, while cupolas, molding machines, tumbling barrels and practically every line of machinery used in a foundry is moving strongly. The American Radiator Co. has bought two 66-inch cupolas for its Buffalo plant, the Austin Co., Cleveland, two 45-inch special cupolas and two 54-inch cupolas, the South Bend Foundry Co., South Bend, Ind., a 54-inch cupola, all from the Whiting Corp., Harvey, Ill. The same concern has sold a 60-ton transfer table to the Midwest Engineering Co., Indianapolis. Architects and engineers have considerable prospective work in hand, both for new foundry constrduction and for re-arrangement and additions to present plants. The Rockford Malleable Iron Co., Rockford, Ill., the Michigan Malleable Iron Co., Detroit, and the Bonney Floyd Co., Columbus, O., recently have purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md. Recent purchasers of tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland, include the Vesta Gas Range & Mfg. Co., Chattanooga, Tenn., the Lakey Foundry Co., Muskegon, Mich., and the Chicago Hardware Foundry Co., Chicago. The National Malleable Castings Co. has ordered sandblast equipment for its Indianapolis plant from the same manufacturer.

Activity Shown in Pittsburgh District

SALES of foundry equipment in the Pittsburgh district recently have been of such a character as to indicate that all casting consuming lines are active. Foundries catering to a widely divergent class of trade have figured in machinery buying, particularly of molding machines. The Herman Pneumatic Machine Co., Zelienople, Pa., reports that inquiries from all sections are engulfing its salesmen and while numerous orders have been received during the past two or three weeks, as many more yet remain to be placed. Among recent buyers are the following: American Cast Iron Pipe & Foundry Co., Birmingham, Ala., special heavy duty pipe molding machine; Edgewater Steel Co., Pittsburgh, jarring machine; Lebanon Steel Foundry Co., Lebanon, Pa., two plain jarring machines; Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., large jarring machine for ingot molds; Ohio Steel Foundry Co., Springfield, O., large rollover machine; Florence Pipe Foundry &

Machine Co., Florence, N. J., large rollover machine; National Supply Co., two rollover machines for Toledo, O., plant; and the Union Steel Casting Co., Pittsburgh, plain jarring machine. The Fort Pitt Malleable Iron Co., Pittsburgh, closed on a large sand mixer with gear drive made by the National Engineering Co., Chicago. Various foundry interests are inquiring for blowers, riddles, sandcutters, etc., and sales of foundry flasks are a matter of weekly record. The Obendorf Mfg. Co., 7509 Thomas boulevard, Pittsburgh, is expected to engage in foundry equipment buying at an early date for a 1-story foundry. The Hinds Co., 107 Catherine street, Malone, N. Y., is said to be in the market for a brass furnace and other miscellaneous foundry equipment, while the Enterprise Foundry Co., 46 Washington street, Auburn, N. Y., is to purchase barrel sandblast equipment, etc. Intermittent buying by foundries of cranes and other types of the heavier equipment is noted in this territory. The Standard Foundry Co., Buffalo, N. Y., purchased a crane and is reported to be contemplating the award of a second. The United Alloy Steel Corp., Canton, O., and the Bethlehem Steel Co., each purchased cranes recently from the Milwaukee Electric Crane & Mfg. Co., Inc., Milwaukee. The Pittsburgh Water Heater Co. and the Damascus Bronze Co., both of Pittsburgh, and the Philadelphia Rapid Transit Co., Philadelphia, recently have purchased sandblast equipment from the Pangborn Corp., Hagerstown, Md. The Erie Malleable Iron Co., Erie, Pa., has ordered four tumbling mills from the W. W. Sly Mfg. Co., Cleveland. Purchases of light hoisting equipment are fairly numerous.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Federal Signal Co., Albany, N. Y., plans the erection of a foundry building.

Erection of an extension to its plant is planned by the Foster Stove Co., Ironton, O.

The Yellow Sleeve Valve Engineering Works, Inc., Chicago, has increased its capital stock from $40,000 to $750,000.

The East Coast Foundry & Cement Works, Lake Worth, Tex., plans the erection of a 1-story foundry building.

Part of the plant of the Price-Evans Foundry Co., Chattanooga, Tenn., recently was damaged by fire.

The plant of the Patterson Foundry & Machine Co., East Liverpool, O., recently was damaged by fire.

Fire recently damaged the plant of the Taplin-Rice-Clerkin Co., Akron, O., manufacturer of stoves, etc.

The proposed foundry of the H. B. Smith Co., Westfield, Mass., will be 1-story, 125 x 200 feet.

The report that the plant of the Oakland Foundry Co., Belleville, Ill., had been damaged by fire, was in error.

The Frost Mfg. Co., Kenosha, Wis., is erecting an addition to its brass foundry at an estimated cost of $35,000.

The Pidgeon-Thomas Iron Co., Memphis, Tenn., plans additions and improvements to its plant.

The Canthrell Hardware & Tool Co., Reading, Pa., has had plans drawn for the erection of a foundry building, 60 x 80 feet.

The Newell Brass Co., Ogdensburg, N. Y., is having plans drawn for the erection of an office addition to cost about $20,000.

Capitalized at $500,000 the Reuther Foundry Co., Bergen and Seventh streets, Harrison, N. J., recently was incorporated.

The Rome Brass & Copper Co., Rome, N. Y., contemplates the erection of a 1-story building, 50 x 180 feet, to be built at an estimated cost of $180,000.

The E. F. Fraim Lock Co., Lancaster, Pa., plans the erection of a 1-story foundry addition, 42 x 170 feet, to be built at an estimated cost of $12,000.

The Forest City Foundry Co., 2488 West Twenty-seventh street, Cleveland, has obtained a permit to erect a foundry building at 3507 West Ninety-fourth street, that city.

The Electric Furnace & Equipment Co., Kansas City, Mo., has been incorporated with $300,000 capital stock by H. J. Plagens, H. N. Olsen and F. H. Longacre.

The Philadelphia Last & Pattern Co., Philadelphia, has had plans prepared for the erection of a 2-story plant building, 50 x 100 feet.

Organized by J. H. Barron, the Motor & Machinery Castings Co., Detroit, recently leased a foundry building for the production of automotive castings.

The F. R. Lueck Co., Milwaukee, has been incorporated with $30,000 capital stock to manufacture pumps. The main stockholder is Frank R. Lueck, 1306 Wells street, formerly president of the F. R. Lueck Mfg. Co.

The Booker Stove & Furnace Co., Ltd., Winnipeg, Man., has been incorporated with a capital stock of $115,000 by Duncan L. Cameron, Douglas R. Jackson, Edmund C. Bridges and others.

Tips Engine Works, Austin, Tex., formerly the Tips Foundry & Machine Co., advises it is in the market for a 5-foot radial drill with tapping attachment. The company prefers a used machine of modern design.

Erection of a 5-unit plant at an estimated cost of $500,000, is planned by the Brunswick-Kroeschell Co., 460 West Erie street, Chicago. The buildings will include a machine shop, pattern shop and a power house.

Contract has been let by the American Foundry & Furnace Co., Bloomington, Ill., for the erection of a 2-story building, 50 x 80 feet, to be erected at an estimated cost of $15,000.

Stockholders of the Kelly Valve Co., Muskegon, Mich., at their recent annual meeting elected the following officers: President, A. M. Larsen; vice president, P. J. Kelly; treasurer, A. J.Ryan; and secretary, Harris L. Galpin.

The Vulcan Iron Works, Ltd., Winnipeg, Man., has awarded the Canadian 'Lectromelt Furnace Co. an order for an electric steel furnace for the production of steel castings. The 'Lectromelt company is a subsidiary of the Pittsburgh Furnace Corp.

Capitalized at $50,000, the Myers Piston Ring Co., Norwich hotel, Columbus, O., recently was incorporated by John F. Myers, T. A. Dean, H. E. Coffman, Helen S. Coffman and Paul B. Coffman. The company is in the market for some equipment.

Borden, Grover & Merrill, Inc., Boston, have been incorporated to make castings, etc., with $25,000 capital stock, by Adrian E. Borden, Newton, Mass.; Donald F. Merrill and Albert M. Merrill, both of Brookline, Mass., and others.

The business of the Liberty Foundry at Fifty-seventh and State streets, Wauwatosa, Wis., has been incorporated as the Liberty Foundry Co. with $125,000 capital stock. The incorporators are William and Henry L. Grede and Ralph L. Lee.

The Pekor Iron Works, Columbus, Ga., builder of steam engines, valves, etc., contemplates the purchase of foundry equipment in the near future. At the present time hand squeezers and pouring devices are being considered. Charles F. Pekor Jr. is manager of the foundry department.

Purchase of the building it occupies from the Woods Construction Co. has been announced by the Lima Foundries Co., Lima, O. It represents an investment of $35,000 and it is understood the plant will be expanded, doubling its present capacity and working force.

The Pittsburgh Engineering Works, Jeannette, Pa., has awarded contracts for three large additional factory buildings to its plant on the eastern outskirts of Jeannette. The additions will cost more than $200,000. The completion of the proposed buildings will triple the present capacity of the plant. Work will start immediately on the excavating and the construction work will begin as soon as the material can be delivered. The chief products of the plant are pipe fittings, valves and heating apparatus.

Negotiations are under way involving the purchase of a steel foundry built in Milwaukee in 1920 by the J. I. Case Threshing Machine Co. of Racine, Wis., but operated only a short period. The probable purchaser is a local syndicate headed by Emil B. Gennrich, one of the founders and secretary of the Hercules Steel Casting Co. The Case foundry is near the Allis-Chalmers works in West Allis. A large electric steel furnace has been obtained for installation in the shop if the purchase is consummated. Mr. Gennrich has said a statement would probably be forthcoming in a few days.

The Springfield Malleable Iron Co., Springfield, Mass., which was incorporated recently with a capital stock of $250,000 and 5000 shares of common stock without par value, has organized by the election of George T. Dewey as president, Henry P. Blumenauer as vice president and William H. Gates as treasurer. These officers hold similar positions with the Baldwin Chain & Mfg. Co., Worcester, Mass., of which the Arcade Malleable Iron Co., of that city, is a subsidiary. They recently purchased the former property of the Harley Co., East Springfield, Mass., from the Hendee Mfg. Co. and will continue to operate it as a foundry after improvements have been made.